THE MARKETS FOR SELECTED
HERBACEOUR ESSENTIAL OILS
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The markets for selected herbaceous essential oils

S. R. J. Robbins and P. Greenhalgh

April 1979

Tropical Products Institute 56/62 Gray's Inn Road London WC1X 8LU
Ministry of Overseas Development

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Tropical Products Institute
ISBN: 0 85954 094 4

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Acknowledgements

The information contained in this report is based on interviews with members of the trade in the UK, France, Switzerland, Belgium, the Netherlands, West Germany, Japan and the USA. The authors wish to acknowledge with gratitude the assistance and advice given to them by all the contacted companies and organisations which either trade in or use herbaceous essential oils and which were prepared to provide information for the purposes of this report. Thanks are also due to the authors' colleagues within the Tropical Products Institute.

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ACKNOWLEDGEMENTS

In compiling this report basic desk research was supplemented by field research in Western Europe, the USA and Japan, during which interviews were conducted with many companies and organisations involved in the trade in herbs. The Institute acknowledges with gratitude the assistance given by importers, processors, research and other organisations and individuals. The author also acknowledges the assistance of colleagues at the Tropical Products Institute.

NOTE

In this report the rounding of figures in the tables may have resulted in some apparent discrepancies.

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Summaries

SUMMARY

The markets for selected herbaceous essential oils

Herbaceous essential oils are obtained by steam-distillation extraction of the aerial parts of plants best known for their application in cooking as fresh, dried or ground herbs. From some herbal plants an oil with different properties can be produced from the seed, and since such oils are closely related to the true herbaceous oils, they have for the most part been included in this report.

For the last few years herbaceous oils have aroused considerable interest in the less-developed countries, and it is for this reason that this report was prepared. However, in contrast to some essential oils, most herbaceous oils are traded in very small quantities and the prospects for new entrants to the herbaceous oils market are moderate to poor.

Most culinary herbs are indigenous to temperate and sub-tropical zones rather than the tropics, and therefore the majority of herbaceous oils originate in these regions.

Although one or two culinary herbs are cultivated, many grow in the wild and are harvested as such. For the most part it is uneconomic to cultivate herbs solely for the production of the essential oil and in very many cases it would not even be economic to distil herbs which were being cultivated principally for use *per se.*

For these reasons alone the prospects for successful production and marketing of herbaceous oils in tropical countries are limited, and cultivation will normally be restricted to cooler, high-altitude regions of the tropics. Prospects for those sub-tropical countries not at present producing herbaceous oils may be slightly better.

Most herbaceous oils are used in conjunction with other oils in a range of industrially-prepared food products, including canned soups and meats, and in various types of perfume preparations. The range of food and perfumery products incorporating herbaceous oils is very diverse. In recent years there has been a trend towards the use of certain herbaceous oils as the main perfume ingredients in their own right, soaps, shampoos and aerosols being notable instances of products exhibiting this trend. In few cases, however, demand for these oils is expanding appreciably and in some cases it is in steady decline.

The herbaceous oils discussed in this report are:

Rosemary oil is produced mainly in Spain, Tunisia and Morocco from the wild growing plant which is not economic to cultivate. World production is approximately 375 to 425 tonnes per annum, of which the USA, France, West Germany and the UK annually consume approximately 90, 75, 50 to 60 and 30 to 50 tonnes respectively. The oil is used more in perfumery than flavouring. Current price is about £6 per kg; supplies appear to be keeping pace with demand and hence there is little need for a new producer.

Dill oil is available as dill weed (herb) oil and dill seed oil. Dill weed oil is the most important, being produced in North America and Europe, whilst dill seed oil is produced in Europe, India and China. Dill weed oil is used mainly by the pickling industry, whilst dill seed oil has wider applications. Annual production of dill oil is between 50 and 100 tonnes, with the USA being the major producer and consumer. In recent years supply difficulties have increased the price of dill weed oil to between £13 and £17 per kg, which is greater than dill seed oil prices. The continued growth of the world pickling and preservative industry should ensure a secure future for dill weed oil, and there is probably room for a new producer supplying limited quantities, perhaps between 5 and 10 tonnes a year. The market for dill seed oil is comparatively small and well serviced by existing suppliers.

Marjoram, thyme, origanum and related oils are dealt with together because of the considerable confusion surrounding the identity and nomenclature of these oils. Sweet majoram, wild majoram and origanum oils are produced in very small quantities and both production and demand are static. Annual production of thyme oils is considerably greater, at about 20 to 30 tonnes, but production and demand are declining slightly, partly because of competition from synthetic thymol.

Dalmatian and **Spanish sage** oils are discussed in the report, whilst clary sage is not dealt with. Annual production of the two oils is about 7 to 15 and 20 tonnes, respectively, with the USA and Western Europe being the major importers. Prices over the past decade have fluctuated sharply in a range of £2 to £14 per kg with a price differential usually in favour of the Dalmatian oil. Total trade in both oils is fairly static and prospects for a new producer are not particularly encouraging, but could improve if the recent decline of Dalmatian oil production becomes permanent.

Celery seed oil, produced mainly in France, India, the USA and the UK, is of far greater commercial importance than celery herb oil, which is produced mainly in Eastern Europe. Estimates suggest a yearly production of celery seed oil of about 15 to 40 tonnes, selling at £41 to £46 per kg, and 1 tonne of celery herb oil, whilst production of celery oleoresin is probably in excess of 100 tonnes. The prospects for celery seed oil are very much dependent on the trend of Indian supplies of the seed, which in the past have shown some irregularity.

Two bitter **fennel** oils are produced, one from the herb in negligible quantities, whilst production of bitter fennel from the seed, mainly undertaken in Europe, India and China, is about 10 to 25 tonnes. Annual production of sweet fennel oil is around 10 to 20 tonnes, mainly from Spain. Generally sweet fennel oil (£11 per kg) is higher priced than bitter fennel oil (£5–£8 per kg). Fennel oils face competition from close natural and synthetic substitutes containing anethole, and overall demand for the oils is unlikely to increase.

There are two commercially important **basil** oils, sweet and Reunion-type, the latter being the most important. Both are produced in very small quantities, probably under 1 tonne of sweet basil and perhaps 7 to 9 tonnes of the Réunion-type. Prices vary widely depending on source and quality and are currently £26 per kg to £50 per kg. The USA is the major market. Growth in demand is slow, but steady, and opportunities exist for a new producer supplying very small quantities of satisfactory sweet and Réunion-type basil oils.

Both **parsley** herb oil and parsley seed oil are produced commercially, but the latter is more widely known and used, particularly in the flavour industry. Total production of both oils is probably less than 10 tonnes, with the current spot price of seed oil at £55 to £65 per kg, the herb oil selling at a considerably higher price. Demand is fairly stable and it is unlikely there will ever be good prospects for a new producer.

Production of **bay** (laurel leaf), **tarragon, chervil, savory** and **garlic** oils is extremely small and it is most unlikely that they could ever be of interest to prospective producers in the tropics or sub-tropics.

Thus only a few herbaceous oils, namely dill weed oil, celery seed oil and basil oil, offer many prospects worth considering at all, and even in the case of these oils, the quantities involved would be small or very small. Other oils which could offer prospects if the supply problems currently being experienced turn out to be long-term rather than temporary, include sage, wild majoram, thyme and origanum. But in no case would the market support major increases in supplies.

Since herbaceous oils are low-volume products, although often of high or moderately high value, the number of links in the trading chain is usually fairly small, or very small. Vital to an intending new producer is the need for regular contact from the outset with a dealer or dealers in the potential importing countries, either direct or through an export agent. In this manner the precise requirements of the market in respect of price, quality, quantities, packaging and so on can be conveyed clearly to the producer. Non-appreciation of the need for such contacts may well lead to failure.

In comparison with many non-herbaceous essential oils, herbaceous oils are generally not threatened with substitution by synthetics, mainly because they tend to be rather more difficult to synthesise. However, thyme and fennel are two exceptions. There was, on the other hand, a noticeable movement away from the essential oils towards the corresponding oleoresins in the late 1960s and early 1970s but this trend has now virtually spent itself.

The broad conclusion of the report is that herbaceous oils offer limited, but still significant potential to a limited number of new producers in the developing countries, although only as secondary crops.

RÉSUMÉ

Marches pour huiles essentielles d'herbacées selectionnées

Les huiles essentielles de plantes herbacées sont obtenues par distillation à la vapeur ou par extraction au solvant des parties aériennes des plantes réputées pour leur emploi dans la cuisine sous forme d'herbes fraîches, séchées ou broyées. Avec certaines plantes herbacées, on peut fabriquer, à partir de la graine, une huile ayant différentes propriétés, et comme ces huiles sont étroitement liées aux véritables huiles d'herbacées, elles ont été, pour la plupart, incluses dans le présent rapport.

Pendant ces quelques dernières années, les huiles d'herbacées ont suscité un intérêt considérable dans les pays en voie de développement, et c'est la raison pour laquelle ce rapport a été préparé. Cependant, contrairement à certaines huiles essentielles, la plupart des huiles d'herbacées sont commercialisées en trés petites quantités et les perspectives de nouvelles entrées sur le marché des huiles d'herbacées sont modérées à réduites.

La plupart des herbes culinaires sont indigènes des zones tempérées et sub-tropicales plutôt que des tropiques, et par conséquent la majorité des huiles d'herbacées proviennent des ces régions.

Bien qu'une ou deux herbes culinaires soient cultivées, beaucoup d'entre elles poussent à l'état sauvage et sont récoltées ainsi. Pour la plupart, il n'est pas économique de cultiver des herbes seulement pour la fabrication de l'huile essentielle et, dans de très nombreux cas, il ne serait même pas économique de distiller des herbes qui étaient cultivées principalement pour usage *tel quel.*

Pour ces seules raisons, les perspectives de production et de commercialisation fructueuses des huiles d'herbacées dans les pays tropicaux sont limitées, et la culture se limitera normalement aux régions plus fraîches, en haute altitude, sous les tropiques. Il se peut que les perspectives soient légèrement meilleures pour les pays sub-tropicaux qui ne produisent pas d'huiles d'herbacées actuellement.

La plupart des huiles d'herbacées sont utilisées conjointement avec d'autres huiles dans une série de produits alimentaires préparés industriellement, notamment potages en boîte et conserves de viande, et dans différents types de préparations de parfumerie. La gamme des produits alimentaires et de parfumerie incorporant des huiles d'herbacées est très variée. Ces dernières années, une tendance s'est dessinée vers l'emploi de certaines huiles d'herbacées comme principaux ingrédients parfumés proprement dits; les savons, shampooings et aérosols sont des exemples notables de produits manifestant cette tendance. Cependant la demande pour ces huiles s'accroît nettement dans peu de cas, et dans d'autres, elle baisse régulièrement.

Les huiles d'herbacées étudiées dans le présent rapport sont les suivantes:

L'huile de **romarin** est principalement fabriquée en Espangne, en Tunisie et au Maroc à partir de plantes poussant à l'état sauvage et elle n'est pas économique à cultiver. La production mondiale s'élève à 375—425 tonnes/an, dont les Etats-Unis, la France, l'Allemagne de l'Ouest et la Grande-Bretagne consomment environ 90, 75, 50—60, et 30—50 tonnes/an respectivement. L'huile est davantage utilisée en parfumerie que pour l'aromatisation. Le prix courant est de £6/kg environ; il semble que les approvisionnements suivent le rythme de la demande; il y a donc peu de besoin d'un nouveau producteur.

L'huile d'**aneth** est disponible sous forme d'huile d'aneth plante (herbe) et d'huile de graine d'aneth. L'huile d'aneth plante est la plus importante, fabriquée en Amérique du Nord et en Europe, tandis que l'huile de graine d'aneth est fabriquée en Europe, en Inde et en Chine. L'huile d'aneth plante est principalement utilisée par l'industrie des marinades, tandis que l'huile de graine d'aneth a des applications plus étendues. La production annuelle d'huile d'aneth se situe entre 50 et 100 tonnes, les Etats-Unis étant le principal producteur et consommateur. Ces dernières années, les difficultés d'approvisionnement ont fait monter le prix de l'huile d'aneth plante jusqu' à £13—17/kg, prix plus élevés que ceux de l'huile de graine d'aneth. La croissance continue de l'industrie mondiale des marinades et des conserves devrait assurer un avenir sûr pour l'huile d'aneth plante et il y a probablement place pour un nouveau fabricant fournissant des quantités limitées, peut-être 5—10 tonnes/an. Le marché de l'huile de graine d'aneth est relativement restreint, et bien servi par les fournisseurs existants.

Les huiles de **marjolaine,** de **thym,** d'**origan** et apparentées sont traitées ensemble en raison de la confusion considérable qui entoure l'identité et la nomenclature des ces huiles. Les huiles de marjolaine douce, de marjolaine sauvage et d'origan sont fabriquées en très petites quantités, et la production et la demande sont toutes deux stationnaires. La production annuelle des huiles de thym est beaucoup plus élevèe, 20—30 tonnes environ, mais la production et la demande déclinent légèrement, en partie à cause de la concurrence du thymol synthétique.

Les huiles de **sauge dalmate** et **espagnole** sont étudiées dans le présent rapport, alors que la 'toute-bonne' ne l'est pas. La production annuelle des deux premières huiles est de 7 à 15 et 20 tonnes environ, respectivement, les Etats-Unis et l'Europe Occidentale étant les principaux importateurs. Ces dix dernières années, les prix ont oscillé dans une plage de £2 à £14/kg, avec une différence de prix habituellement en faveur de l'huile dalmate. Le commerce total de ces deux huiles est assez stationnaire et les perspectives pour un nouveau producteur ne sont pas particulièrement encourageantes, mais pourraient s'améliorer si le récent déclin de la production d'huile dalmate devenait permanent.

L'huile de graine de **céleri,** fabriquée principalement en France, en Inde, aux Etats-Unis et en Grande-Bretagne, a une importance commerciale bien plus grande que l'huile de céleri plante, qui est fabriquée principalement en Europe Orientale. Des estimations suggèrent une production annuelle d'huile de graine de céleri de 15 à 40 tonnes environ, se vendant à £41—46/kg, et 1 tonne d'huile de céleri plante, alors que

la production d'oléorésine de céleri connaît probablement un excédent de 100 tonnes. Les perspectives pour l'huile de graine de céleri dépendent beaucoup de la tendance des approvisionnements indiens en graines, qui ont autrefois présenté une certaine irrégularité.

Deux huiles de **fenouil** amer sont fabriquées, l'une à partir de la plante, en quantités négligeables, tandis que la production du fenouil amer provenant de la graine, principalement entreprise en Europe, en Inde et en Chine, est de 10 à 25 tonnes environ. La production annuelle d'huile de fenouil doux est de 10 à 20 tonnes environ, en provenance d'Espagne particulièrement. En général, l'huile de fenouil doux (£11/kg) coûte plus cher que l'huile de fenouil amer (£5—8/kg). Les huiles de fenouil rencontrent de la concurrence au niveau des succédanés naturels et synthétiques contenant de l'anéthol, et probablement la demande globale pour ces huiles ne va pas augmenter.

Il y a deux huiles de **basilic** importantes au niveau commercial, basilic doux et type Réunion, cette dernière étant la plus importante. Toutes deux sont fabriquées en très petites quantitées, probablement moins d'I tonne de basilic doux et peut-être 7 à 9 tonnes du type Réunion. Les prix varient énormément selon la source et la qualité, et se montent couramment à £25—50/kg. Les Etats-Unis représentent le plus grand marché. La croissance de la demande est lente, mais régulière, et il y a des opportunités pour un nouveau fabricant fournissant de très petites quantités d'huiles de basilic doux et type Réunion, satisfaisantes.

L'huile de **persil** plante et l'huile de graine de persil sont toutes deux fabriquées commercialement, mais la seconde est bien plus connue et utilisée, en particulier dans l'industrie des arômes. La production totale des deux huiles atteint probablement moins de 10 tonnes, avec le prix comptant courant de l'huile de graine à £55—65/kg, l'huile de plante se vendant à un prix nettement plu élevé. La demande est assez stable et il est probable qu'il n'y aura jamais de bonnes perspectives pour un nouveau fabricant.

La production d'huile de **laurier** (feuille de laurier), d'**estragon**, de **cerfeuil**, de **sarriette** et d'**ail** est extrêmement faible et il est très probale qu'elles puissent peu intéresser d'éventuels jamais fabricants dans les pays tropicaux ou sub-tropicaux.

Ainsi, quelques huiles d'herbacées seulement, à savoir l'huile d'aneth plante, l'huile de graine de céleri et l'huile de basilic, offrent des perspectives nombreuses et qui valent la peine d'être considérées, et même dans le cas de ces huiles, les quantités impliquées seraient faibles, voire très faibles. D'autres huiles qui pourraient offrir des perspectives si les problèmes d'offre actuellement rencontrés finissent par devenir à long terme plutôt que temporaires, comprennent la sauge, la marjolaine sauvage, le thym et l'origan. Mais, en aucun cas, le marché ne supporterait des augmentations plus importantes de l'offre.

Comme les huiles d'herbacées sont des produits de faible volume, bien que souvent de grande ou moyenne valeur, le nombre de maillons dans la chaîne commerciale est généralement assez réduit, voire très réduit. Une chose vitale pour un nouveau producteur éventuel, c'est la nécessité d'un contact régulier dès le début avec un négociant, ou des négociants, dans les pays importateurs potentiels, soit directement, soit par l'intermédiaire d'un agent d'exportation. De cette façon, les besoins précis du marché concernant le prix, la qualité, les quantités, l'emballage etc. peuvent être transmis clairement au producteur. Un défaut d'appréciation de l'intérêt de ces contacts peut aboutir à un échec.

Par comparaison avec de nombreuses huiles essentielles de non-herbacées, les huiles d'herbacées ne sont généralement pas menacées d'être remplacées par des produits synthétiques, surtout parce qu'elles sont souvent plus difficiles à synthétiser. Cependant, le thym et le fenouil sont deux exceptions. D'autre part, il y a eu une tendance notable à passer des huiles essentielles aux oléorésines corespondantes à la fin des années 1960 et au début des années 1970, mais à présent cette tendance s'est pratiquement épuisée d'elle-même.

La conclusion générale du présent rapport est que les huiles d'herbacées offrent un potentiel limité, mais encore important, à un nombre limité de nouveaux producteurs dans les pays en voie de développement, bien que ce soit seulement en tant que récoltes secondaires.

RESUMEN

Comercializacion de aceites esenciales herbáceos selectos

Los aceites esenciales herbáceos se obtienen, por destilación al vapor o extracción con disolventes, de las partes aéreas de plantas más bien conocidas por su aplicación en recetas de cocina como hierbas en fresco, secas o molidas. De algunas plantas herbáceas, puede obternerse de la semilla un aceite con propiedades diferentes, y ya que tales aceites están estrechamente relacionados con los verdaderos aceites esenciales, se han incluído en su mayor parte en este trabajo.

En los recientes últimos años, los aceites herbáceos han adquirido considerable interés en los países menos desarrollados, siendo ésta la razón de la realización de este informe. Sin embargo, en contraste con algunos aceites esenciales, la mayoría de los aceites herbáceos se comercializan en cantidades muy pequeñas, y las perspectivas para nuevas entradas al mercado de los aceites esenciales son de moderadas a pobres.

La mayor parte de las hierbas de interés culinario son originarias de las zonas templadas y subtropicales más bien que de los trópicos, y sin embargo la mayor parte de los aceites esenciales herbáceos proceden de estas últimas regiones.

Aunque hay una o dos hierbas que se cultivan, la mayoría se desarrollan en forma silvestre y se recolectan como tales. En general es antieconómico cultivar hierbas exclusivamente para la producción de aceites esenciales y en la mayor parte de los casos no sería incluso económico destilar hierbas que se hayan cultivado principalmente con este destino.

Por estas razones las perspectivas de producción y comercialización con éxito de aceites esenciales, en los países tropicales, son limitadas, y el cultivo normalmente estaría restringido a las regiones más frías y de mayor altitud de los trópicos. Las perspectivas para los países subtropicales, que en la actualidad no producen aceites herbáceos, pueden ser ligeramente mejores.

La mayor parte de los aceites herbáceos se utilizan en unión con otros aceites, en una gama de productos alimenticios, preparados industrialmente, entre los que se incluyen sopas y carnes enlatadas, así como en diversos tipos de productos de perfumería. La gama de productos alimenticios y de perfumería que utiliza aceites herbáceos es muy amplia. En los años recientes ha habido una tendencia hacia el uso de ciertos aceites esenciales herbáceos como el principal ingrediente aromático de propio derecho, en jabones, champúes y aerosoles, siendo notables los ejemplos de productos que muestran esta tendencia. En pocos casos sin embargo la demanda de estos aceites está aumentando apreciablemente y en algunos casos está en rápido declive.

Los aceites herbáceos discutidos en este informe son:

Aceite de **romero**, se produce principalmente en España, Tunicia y Marruecos a partir de plantas que crecen en estado silvestre, y su cultivo no es económico. La producción mundial es, aproximadamente, de 375 a 425 toneladas anuales, de las cuales USA, Francia, Alemania Occidental y el Reino Unido consumen aproximadamente 90, 75, 50 a 60, y 30 a 50 toneladas respectivamente. El aceite se utiliza más en perfumería que como aromatizantes de productos alimenticios. El precio corriente es de unas 6 libras/kg, la oferta parece estar de acuerdo con la demanda y por tanto hay pocas posibilidades para nuevos productores.

El aceite de **eneldo** puede ser aceite de la planta de eneldo o aceite de la semilla de eneldo. El aceite de la planta de eneldo es el más importante y se produce en Norte América y en Europa, mientras que el aceite de semilla de eneldo se produce en

Europa, India y China. El aceite de la planta de eneldo se utiliza principalmente en las industrias conserveras, mientras que el aceite de semilla tiene más amplias aplicaciones. La producción anual de aceite de eneldo fluctúa entre 50 y 100 toneladas, siendo los Estados Unidos el país principal productor y consumidor. En los años recientes diversas dificultades en la oferta han incrementado el precio del aceite de la planta a unas cifras que oscilan entre 13 y 17 libras por kilogramo, precio que es superior al del aceite de semilla. El continuo desarrollo de las industrias mundiales conserveras en sus diferentes modalidades podría garantizar un futuro seguro para el aceite de planta de eneldo, y habrá probablemente sitio para nuevos productores que suministren en cantidades limitadas, quizá hasta 5—10 toneladas más al año. El mercado para el aceite de semilla es comparativamente más pequeño y está perfectamente servido por los suministradores actuales.

Los aceites de **mejorana, tomillo, orégano** y otros afines se tratan de modo conjunto debido a la considerable confusión existente sobre la identidad y la nomenclatura de estos aceites. Los aceites de mejoranas y oréganos se producen en cantidades muy pequeñas y tanto su producción como su demanda son muy estables. La producción anual de aceites essenciales de tomillo es considerablemente mayor, alrededor de 20 a 30 toneladas, pero tanto su producción como su demanda están decayendo ligeramente, en parte a causa de la competencia del timol sintético.

También trata el informe de los aceites esenciales de la **salvia española** y la **salvia dálmata,** pero no trata de la salvia sclarea. La producción anual de aceites esenciales de salvia española y salvia dálmata es de alrededor de 7 a 15 y 20 toneladas, respectivamente, siendo los principales importadores los Estados Unidos y Europa occidental. Durante la pasada década, los precios han fluctuado sensiblemente entre 2 y 14 libras/kg con un precio diferencial normalmente a favor del aceite de salvia dálmata. El comercio total de ambos aceites es bastante estático y las perspectivas para nuevos productores no son particularmente alentadoras, pero pueden mejorar si la reciente disminución de la producción de aceite dálmata continúa de forma permanente.

El aceite de semilla de **apio,** producido principalmente en Francia, India, Estados Unidos y Reino Unido, es de una importancia comercial mucho mayor que el aceite de la planta de apio, el cual se produce principalmente en Europa occidental. Las estimaciones muestran una producción anual de aceite de semilla de apio de unas 15 a 40 toneladas, vendiéndose de 41 a 46 libras/kg, y I tonelada de aceite de planta de apio, mientras que la producción de oleo-resina de apio supera la cantidad de 100 toneladas. Las perspectivas para el aceite de semilla de apio dependen de modo importante de las tendencias de los suministros de semillas de la India, los cuales en el pasado han sido algo irregulares.

Del **hinojo** amargo se extraen dos tipos de aceite, uno procedente de la parte herbácea, del cual se producen cantidades muy poco importantes, y otro procedente de la semilla, obtenido principalmente en Europa, India y China, el cual alcanza una producción de 10 a 25 toneladas. La producción anual de aceite de hinojo dulce se eleva a unas 10 a 20 toneladas, obtenidas principalmente en España. El aceite del hinojo dulce alcanza, generalmente precios superiores (11 libras/kg) a los de aceite de hinojo amargo (5 a 8 libras/kg). Los aceites de hinojo compiten con otros aceites sustitutivos, naturales y sintéticos, que contienen anetol, y la demanda general para estos aceites no es probable que se incremente.

Existen dos aceites de **albahaca** comercialmente importantes, el dulce y el tipo-Reunión, siendo este último el más solicitado. Ambos se producen en cantidades muy pequeñas, probablemente menor de 1 toneladas del tipo dulce y alrededor de 7 a 9 toneladas del tipo-Reunión. Los precios varían considerablemente según el origen y la calidad, siendo normalmente de 26 a 50 libras/kg. El mejor mercado es el de los Estados Unidos. La demanda ofrece un crecimiento lento pero firme y existen oportunidades para nuevos productores que suministren cantidades muy pequeñas de aceites de albahaca de buena calidad de ambos tipos.

Del **perejil,** se producen comercialmente aceites procedentes de la parte herbácea y de la semilla, siendo el aceite de semilla el más conocido y utilizado sobre todo en la

industria aromática. La producción total de ambos aceites es probablemente inferior a las 10 toneladas, alcanzando corrien temente el aceite de semilla un precio en origen de unas 55 a 65 libras/kg, vendiéndose el aceite de la parte herbácea a precios considerablemente superiores. La demanda es bastante estable y no es probable que existan en el futuro buenas perspectivas para nuevos productores.

La producción de aceites de **hoja de laurel, estragón, perifollo, ajedrea** y **ajo** es extremadamente pequeña y es muy poco probable que pueda ofrecer interés a los productores de los países tropicales o subtropicales.

Por tanto, solamente unos pocos aceites herbáceos, principalmente el de eneldo, el de semilla de apio y el de albahaca, ofrecen perspectivas de consideración, e incluso en el caso de estos aceites se tratará de cantidades pequeñas o muy pequeñas. Otros aceites que podrían ofrecer buenas perspectivas, si los problemas de suministro actuales desaparecieran son los de salvia española, mejorana, tomillo y orégano. Pero en ningón caso el mercado podrá absorber aumentos importantes de la oferta.

Puesto que los aceites herbáceos son productos que se comercializan en pequeña escala aunque an menudo alcancen un valor alto o moderadamente elevado, el número de eslabones de la cadena comercial es generalmente pequeño o muy pequeño. Para un nuevo posible productor es de vital importancia establecer desde el principio contactos regulares con los comerciantes de los potenciales países importadores, ya sea directamente o a través de agentes de exportación. De esta manera las necesidades concretas del mercado relativas a precio, calidad, cantidad, envasado, etc. podrán ser transmitidas directamente al productor. Si no se tiene en cuenta la necesidad de estos contactos se puede fracasar en el empeño.

En comparación con muchos aceites esenciales no herbáceos, los aceites herbáceos no están amenazados por regla general con la sustitución por los sintéticos, principalmente porque suelen ser más difíciles de sintetizar. Sin embargo, el tomillo y el hinojo constituyen dos excepciones. Por otra parte, hubo una tendencia clara de sustitución de los aceites esenciales por las correspondientes oleorresinas, al final de los años 60 y principios de los 70, pero esta tendencia ha desaparecido casi por completo.

La conclusión general del informe es que los aceites herbáceos ofrecen un potencial limitado pero importante a un número reducido de nuevos productores de los países en desarrollo, pero sólo como cosecha secundaria.

Introduction

THE SCOPE OF THE REPORT

The purpose of this report is to present an analysis and discussion of recent and present trends in, and future prospects for, international trade in the group of products which can reasonably be termed herbaceous essential oils. These aromatic oils are normally steam-distilled, although in one or two instances solvent extraction of the appropriate parts of the plant may be carried out. However, the majority of these plants are well known and widely used in the fresh or dried state as culinary herbs. There also exists a closely-related class of essential oils known as spice seed oils and, although these are not the subject of this report, in the case of one or two oils some difficulty was experienced in assigning the products in question to one category or the other. Thus, although the oils of rosemary and parsley, for example, clearly belong in the herbaceous oils category and the oils of coriander and caraway are unequivocally spice seed oils, there are a small number which, on account either of their physical nature or of their uses, present a problem. After consideration it was decided firstly that the oils of celery seed and dill seed should be covered in the report alongside the very closely-related, true herbaceous oils of celery herb and dill weed, and secondly that the oils of bitter and sweet fennel seed were so closely associated with herbaceous oils in the eyes of the trade that their exclusion would also be unwarranted. Excluded, in addition to the oils of coriander and caraway mentioned above, are the oils of cumin, fenugreek, anise and star anise which are unambiguously spice seed oils. Also omitted are the oils of lavender and its close relatives, because lavender oil production is almost completely restricted to, and closely controlled by, certain West European countries, and also because it is difficult to regard lavender as a herb in the generally-accepted sense of the word, in spite of there having been occasional instances of its being so regarded.

With one or two exceptions, herbaceous essential oils are nowhere produced in large quantities and, in comparison with very many other essential oils, they must as a group be classed as low-volume products. Many of them are produced more widely in temperate and sub-tropical regions than in the tropics as such, and indeed a large proportion of the plants require the type of cool climate which is never encountered in tropical lowlands.

It must be recognised from the outset that the market opportunities for new producers of these oils are not great, and that the main reason for the preparation of this report was the interest being shown in these oils by numerous individuals and organisations in the less-developed countries. Nonetheless there are a number of high-altitude locations in the tropics where there would be a reasonable likelihood of finding suitable conditions for the cultivation of the herbs from which the oils are produced. It should also be noted that herbaceous oil production tends to be the type of labour-intensive activity which many temperate and even sub-tropical countries are tending to move away from on account of increasing labour costs. The herbaceous plants from which the oils are distilled may be grown either on a plantation scale or by smallholders, although in many cases it would almost certainly not be economic for smallholders to possess their own distillation

equipment. In many high-altitude locations, moreover, transportation can be a problem for farmers and the high value, low volume nature of the type of product under review renders them all the more suitable in consequence.

The conservatism of the essential oils trade requires that the plant strains, cultivation techniques, and distillation and packaging procedures are in every respect compatible with the production of an oil which resembles in its odour and/or flavour and physico-chemical characteristics the established commercial product as closely as possible. The marketing of a known traditional oil which, however, is being produced in a new unfamiliar location can encounter, at least initially, as much trade resistance as the introduction of a new, untried, oil. Nevertheless, many buyers are anxious to have as many supply sources at their disposal as possible in order to minimise the risk of supply bottlenecks.

It must be fully appreciated that, in spite of the fact that extensive fieldwork was undertaken in the UK, the USA, Western Europe and Japan to obtain the necessary information, herbaceous essential oils are very minor products, and not only are published market and statistical data very sparse, but even individual traders, who in general only handle very small quantities, are often in no position to give more than the most general indication of how the oils are used and of the overall size of the market. The even greater lack of information on production, consumption and marketing methods in Eastern Europe, where a number of the oils are produced, was an additional handicap. This report, however, should provide intending or existing producers with a clear indication of the extent to which production could be undertaken or expanded without creating conditions of over-supply on world markets.

THE BROAD PATTERN OF USAGE

Herbaceous oils are generally used in small quantities, mostly in combination with a number of other essential oils. Individually, therefore, they are seldom more than a very minor cost component of a final product, and for this reason price-elasticity of demand for herbaceous oils is generally low, although there are exceptions. Unlike herbaceous oleoresins, of which further mention is made later, many herbaceous oils are used extensively in perfumery applications as well as in flavouring. This has generally entailed the addition of a small quantity of a herbaceous oil to a formulation in order to impart a subtle note to the overall fragrance rather than an obviously herbaceous overall character, and in fact many formulations which were intended to be of an overtly herbaceous nature owe much to ingredients which would not strictly be regarded as herbaceous oils. In recent years, though, the increasing popularity of herbal fragrances in soaps, shampoos and other products has brought about a greater tendency on the part of manufacturers to use herbaceous oils as the 'prime mover' in their formulations.

At this point it is relevant to mention the relationship herbaceous oils bear to herbaceous oleoresins. The latter products are prepared by solvent extraction, followed by solvent stripping to yield a viscous concentrate which contains not only the steam-volatile aromatic components of the plant material, which determine the aroma and largely determine the flavour, but also some of the non-volatile components which may modify and contribute to the flavour. The oleoresins, if dispersed on a neutral base such as salt or rusk, can provide a rather closer resemblance to the 'total', flavour-plus-aroma character of dried herbs than do the oils, and so they have more specific and clearly definable uses, mainly in prepared and canned foodstuffs. However, the resemblance is still only very approximate in many cases, and herbaceous oleoresins are in no way as satisfactory a substitute for the raw material as, for example, are spice oleoresins, and for this reason their adoption has been slower and on a small scale only.

Oleoresin manufacture until fairly recently was carried out only by highly industrialised western nations, such as the UK and West Germany, and by the USA. Although during the last five or six years production has commenced in a number of the herb-

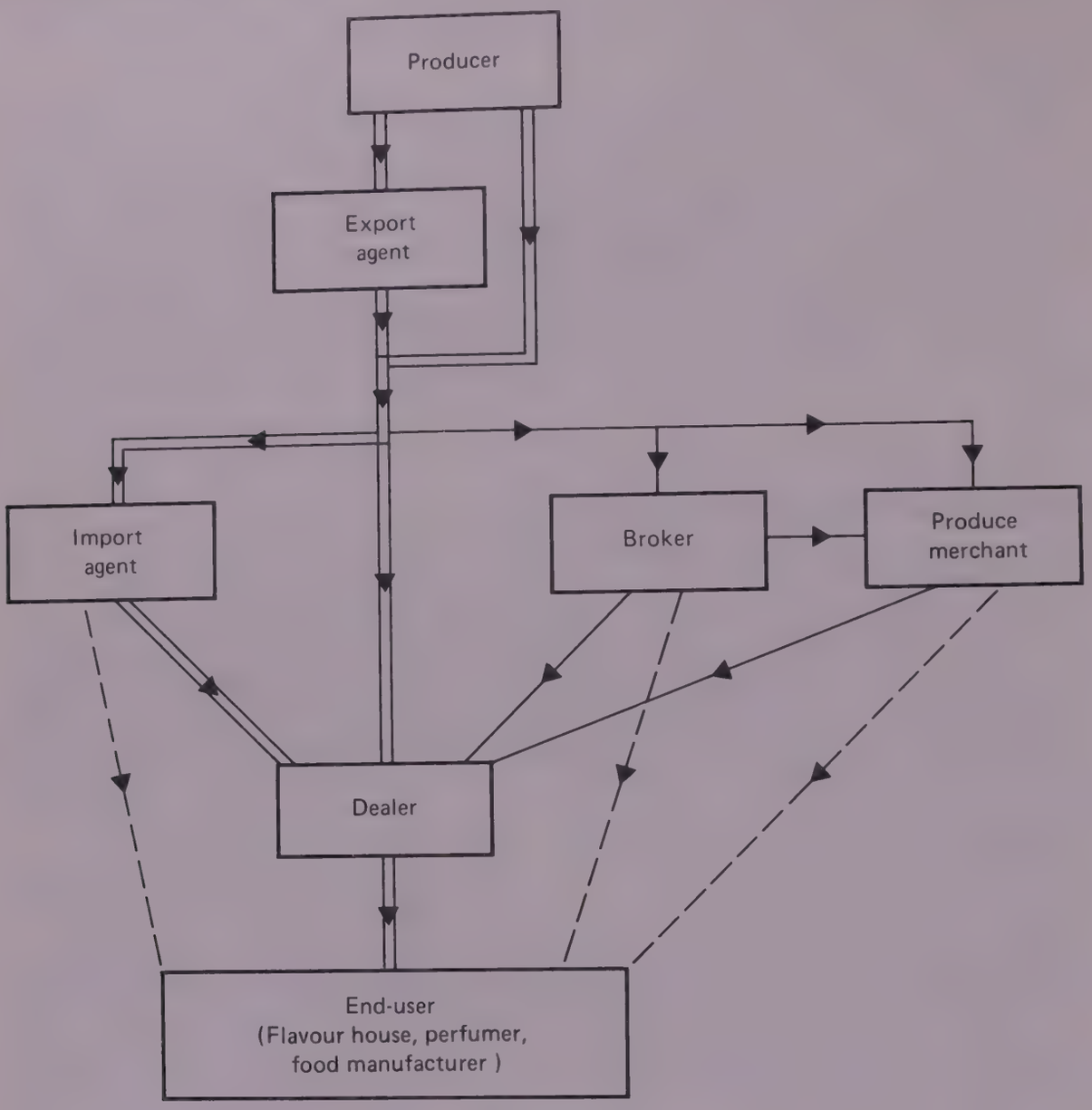
producing countries, the outlook for herbaceous oleoresin extraction at source is meagre, except perhaps in one or two instances, and then only in the long-term. The technology is complex, the process requires close control, the capital outlay is high, and the markets are both small and exacting in terms of quality specifications. Furthermore, even in the case of spice oleoresins, excess capacity has been reported to exist in many of the factories located at source. Nevertheless, in spite of the fact that the principal concern of this report is with the essential oils, the close relationship between oils and oleoresins demands that at least some mention be accorded the latter, particularly regarding the market interface where there are rather similar uses, that is to say, mainly in the food industry. Although there was a very noticeable trend away from the usage of the oils in favour of the oleoresins in the late 1960s and early 1970s, the trend has now virtually spent itself and, although some of the uses of the oils and oleoresins could be described as complementary to one another, there is far less competition between the two types of product than there was.

BASIC MARKETING CONSIDERATIONS

Any producer planning either the production of a known commercial oil in an untried location or the substantial expansion of an existing production is well advised to take steps to ensure that a sufficient number of buyers are at least in sympathy with that intention. The experience of the world's essential oils industries during the past few decades strongly suggests that producers should where possible make a practice of establishing and maintaining a constant and close two-way relationship either with the end-users of the oil or with key intermediate links in the trading structure, such as dealers or brokers, and of consulting and obtaining advice from them regarding any new plans. In the case of low-volume products, such as the majority of herbaceous oils, where the annual requirements of an individual food manufacturer, perfumer or flavour house would be far too small to justify direct producer-user contacts, the key link in the marketing chain should in principle be regarded as the dealer, who buys in a wide range of products for subsequent resale and who will generally be fully conversant with market requirements. It is very possible that many producers of herbaceous oils would find the maintenance of direct contacts with overseas dealers too costly in relation to turnover; if so, an influential contact in the country of origin, such as an export agent handling a number of essential oils and spices and perhaps other products, who could therefore spread the costs, could be of great benefit. It hardly needs saying, however, that an export agent would have to participate very fully in the regular two-way flow of information and advice between producer and dealer. Occasional instances have been observed of a form of direct contact between end-user and producer, whereby advice on quality is transmitted direct to the producer who, however, continues by agreement to market his product through his favoured intermediaries, whether dealer or export agent. This type of arrangement may become more widespread, and where it can be achieved there is much to commend it. It is, however, important that the dealer or agent should be in sympathy with the arrangement, so as to avoid suspicion that any direct sales contracts might be arranged secretly.

The typical marketing structure of the essential oils is given in Figure 1. The double lines in Figure 1 indicate the recommended route for the marketing of herbaceous oils, and indeed signify common routes for many traded products. The single lines indicate other routes which, although common, are regarded as less than ideal for the marketing of herbaceous oils. The broken lines denote less common routes. Several points arise. Firstly, the traditional commissioned broker, who negotiates contracts but withholds the identity of the buyer from the seller and vice-versa, is a very common figure in the produce marketing arena, but where direct contacts are desirable he is more a hindrance than an asset. An import agent, by contrast, generally acts on a commission basis on behalf of the seller alone, and indeed the term 'broker' has in recent times been increasingly applied to this type of intermediary. Provided the agent's knowledge of trade requirements is sound and broad, he can sometimes be a useful alternative to a dealer as the main contact in the importing country, and there are several instances of this system working verysuccessfully, although it is as well to

Figure 1 The typical marketing structure of the essential oils trade



keep the number of links in the marketing chain as small as possible. A general produce merchant may have rather more limited knowledge of the finer points of user requirements and is more likely to take a speculative position in the market; for large-volume products such merchants are of great importance, but they tend not to handle low-volume products such as herbaceous oils. A further, minor point is that some flavour houses or processing houses act as dealers in a secondary capacity either as a conscious end in itself, or on those not infrequent occasions where they find they have oil stocks surplus to their immediate requirements. Finally, although for the sake of simplicity the fact was not depicted in the Figure, many of the higher-volume essential oils are shipped through an important additional link in the chain, namely a major international 'entrepôt', such as Singapore or Hong Kong. This is less true of, and certainly not normally desirable for, low-volume products, and although many herbaceous oils are re-exported from, for example, London, Rotterdam or Hamburg to other destinations, such movements generally consist of supplies from dealers to processing houses or other end-users.

The foregoing considerations are the main ones to be borne in mind when marketing products such as herbaceous oils and few problems are likely to be encountered from other sources. Tariff barriers, once a major obstacle to trade in many commodities, are lower than they were and are certainly most unlikely to constitute a hindrance to the marketing of herbaceous oils. Some details of current tariff levels are provided in Appendix B.

A comprehensive list of the various individuals, firms and organisations contacted during the field work is given in Appendix C.

Rosemary

INTRODUCTION

Rosemary oil is steam-distilled from the flowers, leaves and twigs of the plant *Rosmarinus officinalis*, which grows wild in most of the countries bordering the Mediterranean sea. Although there have been instances of the plant being cultivated in France, these are exceptional and have occurred mainly on account of local demand for small quantities of an oil of the highest possible quality, regardless of cost. For normal uses oil distilled from cultivated rosemary would be far too expensive, and for this reason it is the wild plant which is almost invariably exploited. The oil is generally a pale yellow or nearly colourless liquid, with a strong, fresh herbaceous odour.

The main producing countries are Spain, Tunisia and Morocco. Among the minor producers, Yugoslavia has exported rosemary oil in most recent years, and there is some Italian production in Calabria and Sardinia, but this infrequently reaches the export market. Egypt has on occasions been recorded as exporting the oil. In one or two other countries, mainly in South America, interest has been shown in the possibility of producing rosemary oil, but there have been no positive indications as yet of the imminent arrival of any new producer.

Other solvent extractives of the rosemary plant include an oleoresin, a concrete and an absolute oil, the last two products being expensive prepared perfumery materials entailing extensive refining. None of these items is produced in appreciable quantities, apart perhaps from the oleoresin, and in any case their uses are quite distinct from those of the oil. A more important product is terpeneless rosemary oil, which is a direct derivative of the standard oil with specialised uses in high-class perfumery, particularly when combined with olibanum and cinnamon bark oils, and in medicinal and pharmaceutical applications. Also available are artificial rosemary oils, which consist of a mixture of natural rosemary oil and various isolates which may have been derived from natural or synthetic starting materials. These artificial oils are cheaper and, when they are available, provide a highly viable alternative in the event of excessively high prices for the natural oil.

Rosemary oil is used more in perfumery than in flavouring. It is used in its own right in soaps and shampoos, particularly since herbal fragrances became popular. It is also an important ingredient in many preparations of the eau de cologne type, and the cheaper oils are used in the perfuming of a range of soaps, deodorants, room sprays, insecticides, disinfectants, and numerous applications where a pleasant fragrance is needed to mask less pleasant odours. It is also widely used in combination with other essential oils, notably pine needle, lavender and various citrus oils. In the flavouring field, rosemary oil has uses in a range of meat and baked products, and in sauces and seasonings, although it is difficult to cite any one application as being predominant. The oil is also used in some pharmaceutical products, including a number for the relief of stomach disorders, and in one or two health foods.

The oleoresin of rosemary is used in very small quantities in flavouring, cosmetics and pharmaceuticals. Users do not, however, regard it as a substitute for the oil,

and demand for it is in any case small; it is not a product of any consequence in the context of the market for the oil.

PRODUCTION AND EXPORTS

Rosemary oil is one of the largest-volume herbaceous oils in the international market. Total world production is currently of the order of 375 to 425 tonnes per annum, of which Spain and Tunisia each contribute an average of 160 to 180 tonnes and Morocco 40 to 50 tonnes. Yugoslavia exported 18 tonnes during one year, but this is an unusually high figure for that source, although it is possible that production, as distinct from exports, is slightly greater. Production in Italy, France and Egypt is unlikely to be more than one or two tonnes per annum in each instance. Most producers export the greater part of their production

Spain used to be by far the largest producer of rosemary oil, but the development of the tourist and other industries provided more remunerative occupations for the farmers, who traditionally collected and distilled the rosemary plant, and so production somewhat declined. Recently however, there appears to have been a partial recovery, probably as a result of the higher prices now ruling. Spain currently exports an average of just under 200 tonnes per annum, but 15 to 20 per cent of these exports are in fact re-exports of imported Tunisian and Moroccan oil. This refers to only a small proportion of Tunisia's exports, but Spain handles quite a large proportion of the oil exports from Morocco. For this reason a straightforward aggregation of export figures for the main producers gives a somewhat inflated impression of world exports, which in fact are of the order of 350 to 400 tonnes per annum. Some Spanish exports consist of blends of true Spanish oil with one or other of the imported oils — a practice which is not by any means welcomed by all users. Even less popular is the admittedly not very common practice of adulterating rosemary oil with sage oil. There have also been reports of an equally unwelcome practice of describing as 'Spanish oil' consignments imported from Tunisia and Morocco. On the whole, however, the Spanish product has a good reputation, although its characteristics can vary appreciably.

Tunisian rosemary oil nowadays seems to be regarded as the best available high-volume oil. Production in Tunisia was expanded sharply at the time when Spanish production appeared to be in decline. Although Spain's production partially revived, the rising world demand obviated any necessity for a cut-back in Tunisian production. Local farmers are the main driving force in the industry and production is undertaken on a basis similar to that in Spain. There is a small amount of local consumption in Spain, whereas virtually all Tunisia's production is exported.

The quality of Moroccan oil is known to be good, but no details are available of the organisation of production in the country. The level of production is not great in comparison with Spain or Tunisia, but there is no reason to believe that it will decline.

Although the consensus of opinion is that France is only a very small producer of rosemary oil, there are substantial re-exports from that country. In particular, a large proportion of Japanese imports of rosemary oil are from France.

Little is known of how Italian or Yugoslav production is organised, but the oils exported are of very high quality, comparable with the best oils from France and the UK which are distilled in only very small quantities. It is the highest qualities of oil which are used in fine perfumery.

The UK, West Germany, the USA, France and Italy are the main destinations, in that order, for Spanish oil. Appreciable quantities also go to South and Central America, notably Mexico. For Tunisian oil, the main destinations are France (generally well over 50 per cent), the USA, Switzerland, Spain and the UK. West Germany and the Netherlands also take moderate quantities from Tunisia. Moroccan supplies are shipped predominantly to Spain and France. The bulk of the re-export trade is attributable to France and Spain.

Although production and exports are largely limited naturally to the summer months, in Spain at least there is a small amount of winter production. This yields an oil of slightly different quality, but helps a little to smooth out market fluctuations.

MARKETS

The United States of America

In the USA, rosemary oil is used in the manufacture of a range of perfumery products. It is used in its own right for the scenting of soaps, and in combination with other oils in cologne-type products and fine perfumes, as well as in one or two food-flavouring (particularly meat-flavouring) applications. There is also a very small usage in pharmaceuticals notably rubefacient liniments. As there is no local production, all requirements have to be imported. Imports have been subject to strong year-to-year fluctuations, but the long-term trend, as revealed by moving averages, has been one of nearly constant, or maybe slightly rising, demand. However, in real terms, that is, in relation to the volume of sales of food and perfumery products, US consumption of rosemary oil has declined. This was underlined by several dealers and users who pointed out that, among the herbaceous essential oils, rosemary oil is more susceptible than the average to inroads by synthetic substitutes, particularly in soap and perfumery applications. One user stated that when the price of rosemary oil was too high eucalyptus oil was sometimes used as an extender, but this is unlikely to be a common practice.

The size of the US market for rosemary oil is currently around 90 tonnes per annum. Heavy speculative buying during the boom period of 1973–74 gave rise to imports of 103 and 168 tonnes in those two years respectively, whereas in 1972 and 1975 imports were 74 and 30 tonnes respectively. Imports of Spanish and Tunisian oils are approximately equal in quantity. France was a much more important supplier during the 1960s than at the time of writing, and in any case much 'French' oil is of Tunisian or Spanish origin. The import statistics suggest that very little Moroccan oil is used, but trade comment indicated that an appreciable proportion of the so-called 'Spanish oil' imports are actually of Moroccan origin. During the mid-1960s, supplies from Japan, Brazil and Malaysia were recorded, but no consignments from these sources have been reported in recent years. For the most part, prolonged shortages of rosemary oil have not been experienced by US buyers, although the recent boom distorted trading patterns for a short time. Most of the imports into the USA of rosemary oil are of National Formulary grade.

Western Europe

Trade statistics seldom separate rosemary oil from other oils where the imports of individual Western European countries are concerned, and it proved necessary to rely on the export statistics of the producing countries and on the opinions of traders and processors handling the oil, although there were considerable differences among the latter. France presented a considerable difficulty in that there are many re-exports from this country. Tunisian exports to France alone have often well exceeded 100 tonnes per annum, and indeed have averaged nearly 120 tonnes per annum in recent years, while Spanish and Moroccan exports to France totalled some 50 to 60 tonnes annually. From this it would appear that France imports a total of around 170 to 180 tonnes annually. However, an analysis of the imports into other countries of rosemary oil from France suggests that French consumption of rosemary oil is unlikely to exceed 75 tonnes, and may be less. Almost all French consumption is attributable to processing companies and perfume houses, very little being used in food products. As in the USA, there is no strong evidence of substantial long-term market growth.

The West German market for rosemary oil appears to be of the order of 30 to 50 tonnes annually. On balance, the Tunisian oil appears to be preferred on account of the Spanish reputation for mixing oils of different qualities and origins, but Spanish oil is nevertheless used and one or two companies prefer it. Again the oil is used

widely in the manufacture of perfumes, soaps, and foam bath products, but it was also reputed that rosemary oil is used in certain pharmaceutical products — this usage appearing to be more important than food flavouring, in which the oil is little used. The cheaper oils are used in a range of household products, such as aerosols, probably as odour masks. Although it was not reported that there had recently been any substantial inroads into the rosemary oil market by synthetic substitutes, it would appear that artificial rosemary oils are used in the very cheapest, utility products. No great growth in this market is foreseen.

Estimates of the size of the UK market were found to vary, but it is likely that the true figure is in the region of 50 to 60 tonnes per annum. Although Spanish oil has traditionally been preferred, the qualities of Tunisian oil are acknowledged and the latter has acquired a firm foothold in the UK market. The Spanish oil, however, still accounts for approximately 80 per cent of UK demand. Most of the rosemary oil imported into the UK is used by a small number of large companies for the perfuming of a range of soaps and detergents. The stringent quality standards set by these companies necessitate close control over the quality of their raw materials, and although on a world-wide basis the demand for rosemary oil is rather more price-sensitive than for some others, in the UK the quality of the oil is the dominant criterion. No appreciable increase in this market has been recorded in recent years, and in relation to end-product demand it would appear that the importance of the oil is slowly diminishing, in spite of its somewhat increased use as a cheap and rather crude substitute for lavender oil. No direct synthetic substitutes appear to be in use.

The Netherlands re-exports a proportion of its imports of rosemary oil, but local consumption is estimated to be of the order of 10 to 15 tonnes per annum. Several large processing companies exist in the Netherlands, and they reported regular use of rosemary oil in a range of herbal perfume compounds and savoury flavouring preparations. Supplies are obtained from Spain and Tunisia, in roughly equal amounts. Little or no increase in demand is expected from this market.

Of the other Western European users, Italy imports an average of 7 to 10 tonnes per annum, mostly Spanish and mainly for use in perfumery. A Swiss dealer handles 2 to 5 tonnes per annum, but it is likely that much of this is re-exported. Clearly large quantities are used in Spain, but it is not possible to ascertain the actual amounts because of uncertainties surrounding the production and trade statistics.

Other markets

Among the many other regular importers of rosemary oil, Japan imports 6 to 8 tonnes per annum, Brazil 3 to 4 tonnes, Mexico 5 to 7 tonnes and Australia up to 5 tonnes per annum. Numerous other countries import quantities of up to 2 tonnes per annum. It is possible that the pattern of usage in all cases is similar to that applying in the USA and in the major Western European consuming countries.

Market structure

As already indicated, rosemary oil is one of the largest-volume herbaceous oils, and although the dealer is by far the most important link in the marketing chain, it is more likely to arouse interest among import agents and general produce merchants than many or the low-value oils. Brokers also play a significant part. There appears to be a proportionately greater re-export trade in this oil than in most other herbaceous oils and, in addition to France, Spain and the Netherlands, re-exports of small quantities have from time to time been made by the UK and the USA. It would also appear that rosemary oil is more susceptible to speculative pressures than are most of the oils with which this report is concerned, although it is not so vulnerable as the really large-volume essential oils.

PRICES

Movements in the prices of rosemary oil from three sources are shown in Table 1, Appendix A. Because of the narrower market structure for this oil in comparison with

some other herbaceous oils, there is less tendency for the London and New York prices to differ appreciably. At one time Tunisian oil was sold at a price premium over Spanish oil, a fact which mainly reflected quality differences. From 1974, however, the Spanish oil was the more expensive, although the most recent quotations suggest that the position may be reversed. During the last three years, Moroccan oil has often been more expensive than either of the other two, and although the Moroccan oil is of very good quality the price may in fact have reflected short-term shortages. Price and demand appear to adjust to each other fairly readily in the case of this oil, although synthetic substitutes are not readily available.

Quotations at the end of 1977, were as follows:

Moroccan	£6.00/kg spot;
Spanish	£5.45/kg shipment;
Tunisian	£6.00/kg spot.

It would appear that these prices represent the post-1974 'typical' levels and there is no evidence of marked disquiet on the part of the essential oils trade.

PROSPECTS

The most important single observation to be made in the case of rosemary is that it would not be economic to cultivate. Although it is now more expensive than it was before the 1974 boom and is likely to remain so, it is essentially a cheap oil used in large-volume consumer products, and any attempt at cultivation, as distinct from harvesting the wild shrub, would necessitate a price level that would nullify any initial interest in the oil, regardless of quality. Both quality and price are important, and only countries endowed with the wild-growing true rosemary herbs would be advised to attempt production. In no sector, however, is there much or any evidence of any appreciable market growth, and as supplies would appear to be keeping pace with demand, there is little need for new suppliers. Tunisia would certainly appear to be in a position to expand production if any of the others were to reduce theirs. As long as the current, reasonably satisfactory situation in respect of price and quality is maintained, users should be under no pressure to seek substitutes, in spite of the existence of the above-mentioned low-priced imitations, which in any case rely partly on the natural oil as an ingredient. The fact remains, on the other hand, that although the imitations are only approximate, they have proved acceptable to certain users when the price of the natural oil was too high.

Dill

INTRODUCTION

There are three commercially-known oils of dill. Dill weed oil, sometimes known as dill herb oil, is distilled from the stalks, leaves and seeds of *Anethum graveolens*, and is therefore a true herbaceous oil. European dill seed oil is obtained by steam distillation of the ripe fruits of *A. graveolens*, whilst Indian dill seed oil is obtained from a separate species *A. sowa.* The most important of the oils is undoubtedly dill weed oil, particularly the North American type. The bulk of US production takes place chiefly in the state of Oregon, and also in Idaho, Indiana, Michigan and Ohio. Production of dill weed oil is also undertaken in Eastern and Southern Europe, the best-known producers being Hungary in particular, and also Yugoslavia, Romania and Bulgaria. European dill seed oil is produced mainly in Northern and Western Europe, particularly in West Germany, Poland, the UK and the Netherlands; other producers, current or recent, include Canada, Brazil, France and even the USA and India, but in these cases production is normally either irregular or very small scale or both.

Although there is no very great difference between the North American and Eastern European dill weed oils, the European oils sometimes fail to conform to US specifications on account of their low carvone content. Thus although US oils are readily saleable in Europe the opposite is not always true. Weed oil is sometimes graded into 'extra' and 'standard' grades, with 35 per cent and 25 to 30 per cent carvone contents respectively. The US Essential Oils Association stipulates a carvone content of between 28 and 45 per cent, so some 'standard' grade oil does not conform to the Association's requirements. In the same way the European dill seed oils tend to differ from Indian seed oil in so far as the latter has a higher dillapiole content but also a lower carvone content. Generally speaking, the seed oils contain more carvone than the weed oils, and indeed one North American processor claims that it is possible to produce an oil indistinguishable from dill seed oil merely by adding carvone to dill weed oil.

Dill weed oil is mainly used for flavouring and seasoning purposes in the food industry, being used particularly in pickling. It is also used in the formulation of compounded oils for sauces, baked goods and condiments, and is used in one or two countries in the flavouring of meat products. European dill seed oil has a rather wider range of uses. It is used in the pickling and meat industries, but one source suggested that dill weed oil has practically replaced dill seed oil in food flavouring because of the herbaceous freshness that the former imparts. In medicine dill seed oil or its emulsion is employed in gastro-intestinal disorders, especially in flatulence of infants, and is thus an important ingredient of gripe waters and related products. Dill seed oil can also be used for the isolation of carvone, whilst its caraway-like odour and flavour enable it to be used in soap and perfumery in place of caraway oil. These latter uses are not of any great importance. There also exists a dill oleoresin, but this is manufactured in small quantities from the dill seed. There is no discernible trend in usage from oil to oleoresin, probably because an oil, by its very nature, is more convenient in pickling applications.

Whilst European dill seed oil is official in many *Pharmacopeias*, Indian dill seed oil is not considered a suitable substitute, partly because of its low carvone content and partly because it contains dillapiole, a suspected toxic substance. Nevertheless, the US Food and Drug Administration argues that '. . . there is no evidence in the available information on dill and Indian dill that demonstrates a hazard to the public when used at current levels'. Indian dill seed oil is used to flavour baked goods, meats and condiments, but it is much less important than European dill seed oil, which in turn is less important than dill weed oil. Indian dill seed oil also has limited uses in the pharmaceutical and perfumery industry.

PRODUCTION AND TRADE

World production of dill oils is currently in the region of 50 to 100 tonnes per annum, and has not displayed any notable growth or decline in recent years. Production statistics are scarce and in many instances non-existent. Trade opinion has indicated that annual US production of dill weed oil is in the range 35 to 70 tonnes, and Eastern European production is of the order of 10 tonnes, although in some good years Hungary also has produced this amount. World production of European dill seed oil is unlikely to exceed an annual average of 10 tonnes, although in some individual years it may have done so. Production of Indian dill seed oil is smaller than European dill seed oil, and one source quotes production of the former being 900 kg per annum in the mid-1960s. Indian exports in recent times have averaged less than one tonne per year. Although Indian dill is extensively cultivated for its aromatic herb and for the seed crop, it is most unlikely that the level of production of the seed oil approaches that achieved in Europe. Unfortunately no information is available on Chinese dill seed oil production other than that the majority of exports are to the USA.

The USA is the major consumer of dill oil and most of its production of dill weed oil is consumed within the national boundaries. At the same time the small proportion that is exported is of sufficient volume to be of importance in the consumption patterns of the main European consuming countries. A small proportion of European weed oil and seed oil production is exported to the USA but it would appear that the greater part of Chinese, Canadian, Brazilian and even Indian production is taken by US dealers and processors. The bulk of Eastern European production is consumed both within the Comecon countries and in Western Europe. There have been sharp fluctuations in production recently and, since domestic requirements take quite a large proportion of production, exports from Eastern Europe have fluctuated even more so. Furthermore it is understood that the Eastern European producers have sometimes withheld supplies temporarily as a means of 'playing the market'. Consequently, supplies from this area are a cause of periodic anxiety among dealers and processors, but, in spite of this, there is no doubt that Eastern Europe will continue to be a major source of supply.

Among Western European producers, only West Germany is a regular exporter, although that country also services most of its internal requirements of dill seed oil. One or two major processing houses in the UK and the Netherlands produce dill seed oil from locally grown dill, but this is almost entirely for local consumption. The same is probably true of France. India is probably a market of some importance, although a fair proportion of its production is consumed locally.

The oils are traded through the usual network of dealers and export and import agents, the structure of the market exhibiting no special features. Hungary exports most of its oil through the organisation Medimpex, and most other Eastern European countries have their own national exporting agencies.

MARKETS

The United States of America

As well as being the world's main producer of dill weed oil, the USA is also the main consumer. Domestic annual consumption is in the range of 30 to 60 tonnes, and

all but a small percentage of this is used in pickling, most of the balance being used in food flavouring. However, it is clear that some users favour the European weed oil since small quantities of it are imported; the fact that the US oil is at the same time exported indicates that the imports are not merely a 'topping-up' of local production to meet domestic demand. Some dill seed oil is also imported for use in pharmaceutical and perfumery products, as well as in the flavouring of certain savoury products. The main sources of seed oil appear to be India, China and West Germany, with occasional consignments from Canada and Brazil. One source suggested that Indian dill seed oil is rectified to remove the dillapiole and some carvone is added. Under conditions of stable prices the US market for dill weed oil could be described as slowly expanding, but recent high prices have caused considerable anxiety and at least one user volunteered the opinion that prolonged high prices would almost certainly induce a fall in demand. The US market for both European and Indian dill seed oil is little more than static. Some adulteration of, or other forms of tampering with, the occasional consignment of dill oil has been reported, and this has also caused anxiety. The practice of adding carvone to dill weed oil to give a close representation of dill seed oil has already been referred to, and it is also possible that caraway seed oil has been used as an adulterant.

Western Europe – The West German market for dill oils is estimated at 5 to 7 tonnes per annum and rising. The market is shared about equally by European dill seed oil and weed oil, and a proportion of the national requirements of the former is locally distilled. Some companies in fact appear to own their own dill plantations and this also applies to some other Western European countries. The balance of seed oil is imported from Eastern Europe while the dill weed oil requirement is met by imports from both Eastern Europe and the USA. The seed oil is used in pickling and in the flavouring of sausages and canned meats, while the main use of dill weed oil is in the pickling and preservation of gherkins and similar small vegetables of the cucumber family. There are not many perfumery and pharmaceutical uses, and those that do exist are likely to be met increasingly by the use of the dill extracts, tinctures and oleoresins produced by a major company, rather than by the oils, most particularly where pharmaceuticals are concerned. As indicated above, the market is at present an expanding one, but it is also price-sensitive and the present price of US dill weed oil is regarded as excessive and conducive to an eventual decline in demand.

The United Kingdom and French markets for dill oils are not as large as the West German, and are estimated at 3 to 5 tonnes per annum for each country. The balance of usage is fairly similar to that in West Germany, and in both countries the weed oil is the more widely used. Only very small quantities of either oil are used by the perfumery industry, although in the UK dill seed oil is readily used in perfumery when caraway seed oil is either unavailable or too expensive. At least one UK firm possesses its own dill plantations, and it is very possible that some French companies do the same. In neither country does demand appear to be increasing to any degree.

The Netherlands is an even smaller consumer. Annual consumption of dill weed oil, which is obtained mainly from Hungary and intermittently from the USA, is a little over 1 tonne. Consumption of dill seed oil is still smaller, maybe 200 to 400 kg, and supplies are either locally distilled or obtained from West Germany. The weed oil is, as elsewhere, used mainly in pickling and, to a lesser extent, in miscellaneous savoury flavouring applications. In contrast to consumption in most other countries, however, the seed oil is used rather more in a range of perfumery products than in flavouring.

Other markets – Few other Western European countries, if any, consume annually more than a few hundred kilograms of either dill oil, and their consumption patterns do not differ from that broadly described above. It has been reported that the Eastern European countries are consuming more of their own output of dill oil and that this is a contributory factor to the intermittent supply problems. Although it is quite possible that domestic consumption is in fact slowly increasing, it is more likely to be crop failures and other natural setbacks, however, that are the ultimate

cause of the bottlenecks. In India dill and seed oil is used in 'dill water' as a carminative, and in the scenting of soaps, but there are also many flavour uses. It is probable that the greater part of the balance of consumption of the dill oils is in the Asian countries and in the Far East, where the characteristic flavour is likely to be favoured in a wide range of edible products.

PRICES

Table 2 of Appendix A gives a comparison of prices of the oils of dill from various sources as available. It can be seen that weed oils are generally more expensive than seed oils. The one firm quotation for Hungarian weed oil (£14 per kg) suggests that it is currently not very much cheaper than US weed oil. One dill oil of unspecified origin has been priced at over £13 per kg since as far back as 1968, and the only possible conclusion is that these particular quotations are for a very high quality oil distilled by a Western European company for use in very exacting applications. Such an oil would not have entered into international trade in large quantities.

Both temporary shortages and rising costs of production have contributed to the current price of US dill weed oil, and it seems unlikely that current levels can be maintained for any length of time, and indeed it is important that they should not be, since in the pickling industry the cost of dill weed oil can be a significant proportion of total costs. It is even less likely that the price of Hungarian dill seed oil can be maintained for long. In general European dill seed oil is appreciably more expensive than Indian dill seed oil.

The most recent quotations for the oils of dill were as follows:

US dill weed oil ('extra')	£17.35 per kg c.i.f. US;
US dill weed oil ('standard')	£13.15 per kg c.i.f. US;
Hungarian dill seed oil	£14.50 per kg spot.

PROSPECTS

It has already been stressed that many users regard the current price of dill weed oil as a disincentive to its use, but in the event of a reversion to more acceptable price levels there is no reason to believe that the oil has other than a secure future, particularly in view of the healthy state of the world's pickling and preservation industries. As the world supply situation has been somewhat difficult for the past five or six years there is probably room for a new entrant to the market, provided that an oil of a quality comparable with that of the US oil can be obtained. However, the limit of additional supplies would have to be no more than 5 to 10 tonnes, at least initially. The market for European dill seed oil is comparatively small and, since it is fairly well serviced by present suppliers, there is no immediate need for for additional oil. Indeed, a producer of dill weed oil could easily switch into seed oil if market considerations so dictated. The market for Indian dill seed oil is also small and no apparent supply difficulties exist. Moreover, Indian dill is fairly widely cultivated both in India and in other countries of South-east Asia and in Japan for its fresh aromatic leaves and fruits, and thus sufficient starting material exists to satisfy any shortage of Indian dill seed oil that may arise.

Although there are alternative routes to the chemical carvone, the most important constituent of the dill oils, none at present offers sufficient attraction to constitute a threat to the natural oils. It is always possible that dill oleoresin may at some stage begin to make inroads into the market for the oil, but at present the two types of product appear to coexist rather than compete.

Marjoram, origanum, thyme and related products

INTRODUCTION

The terms marjoram oil and thyme oil, as they are commonly used, denote oils as distinct from one another as any other two products covered in different chapters of this report. The reason for their being studied in this report under a single heading is that in practice the terms conceal the existence of a range of commercial herbaceous oils, no fewer than six in number, and that as a result there is very serious potential for confusion, in spite of the fact that some of the oils are of minor importance only. Part of this confusion arises from inconsistencies with regard to the common titles of the oils and the botanical names of the plants from which they are distilled and in the paragraphs which follow an attempt is made to disentangle the nomenclature and minimise the risks of misidentification. The magnitude of the problem will be very clear from the following descriptions of each oil.

Sweet marjoram oil – This relatively unimportant oil is distilled from the dried leaves and tops of the plant *Origanum majorana*, or *Majorana hortensis* as it is sometimes known. This herb is the culinary marjoram widely-used by housewives throughout the world, but although it is very widely grown, distillation of the oil is a minor activity and world production is only of the order of 1 or 2 tonnes per annum. The best oils are produced in France and in North Africa, notably Tunisia, but a number of other European countries, including Hungary, Bulgaria, West Germany and Italy have also produced the oil. The quality and characteristics of the oil are said to vary quite markedly according to source, but the French and Tunisian oils are fairly consistent, and this is probably also true of the Hungarian and Moroccan oils. There have been occasional reports of adulteration of marjoram oil with terpineol. Sweet marjoram oil has limited uses in the flavouring of meats and canned products, and a little is used in perfumery. Neither demand for, nor production of, this oil is expanding.

Wild marjoram oil – This is the main marjoram oil of commerce. It is sometimes known as Spanish wild marjoram oil or Spanish marjoram oil, on account of its main origin, but also quite frequently merely as marjoram oil. The name wild marjoram oil properly applies only to oil distilled from the flowering herb of *Thymus masticina* or other *Thymus* species almost indistinguishable in odour, which grow wild in Spain and are distilled locally. It is very distinct in character from sweet marjoram oil. World production of this oil is in the region of 10 tonnes per annum, and although some of the evidence was contradictory, the overall impression obtained was that very little is produced in countries other than Spain. As with sweet marjoram oil, the quality is said to vary considerably, probably owing to varietal or regional plant differences. Opinions differ on the question of whether or not this oil is used in perfumery, and it seems as if the pattern of usage varies appreciably from country to country. An assessment of all the available opinions and evidence suggests that the oil is now regularly used for the perfuming of soaps and shampoos, although the greater part of world production finds its way into canned meats and other canned foods, and into certain sauces and condiments. World demand appears to have been in a state of slow decline over the years, although it may now have reached a position of stability.

Oregano oil – This oil is much more often known as wild marjoram oil or origanum oil but it is neither. The true origanum oil is discussed in the next paragraph. Oregano oil is distilled from the herb *Origanum vulgare,* which is the familiar culinary herb widely known as oregano and extensively used in food preparations of the pizza type. Unfortunately, even the herb is sometimes known as wild marjoram. Because of the understandable ease with which the oil is confused with origanum oil, it proved very difficult to disentangle the conflicting information obtained in relation to this oil, but it would appear that world production is small, probably no more than 1 tonne, and limited to Italy, Belgium, the USSR and possibly Spain, although some members of the trade think it is also produced elsewhere in Western and Eastern Europe and in North Africa. Italy is of course the home of the well-known pizza, and it is very possible that production of the oil originated there. Oregano oil is in fact used for the most part in flavouring certain meat and baked products, and indeed its uses appear to reflect closely to those of the herb. This is an unimportant oil, since very little enters international trade.

Origanum oil – This is one of the most important of the oils discussed in this chapter. It is distilled only from the herb *Thymus capitatus*, a plant indigenous to Spain and to the Middle East and Asia Minor. It will be appreciated that to apply the title origanum oil to an oil which is not even produced from a member of the *Origanum* species is to invite constant confusion and misunderstanding, and the situation is worsened by occasional trade references to the oil as wild thyme oil. The oil is produced mainly in Spain and Israel, although consignments from Lebanon have frequently been recorded and production in Syria and Turkey has been reported. Origanum oils are distinguished from the rather similar thyme oils by the fact that their dominant constituent is the phenol carvacrol rather than thymol, the main component of thyme oil. Unlike thymol, carvacrol is expensive to synthesise, a fact which is reflected to some extent in a comparison of market trends for the two oils. Even so, mutual adulteration of the oils of origanum and thyme is far from uncommon. World production of origanum oil has never been known with any accuracy, but the consensus of opinion suggests that the order of magnitude is 10 to 12 tonnes, of which the greater part is produced in the Seville area of Spain, Israel's production being comparatively small. The main applications of origanum oil are perfumery and pharmacy, its use in flavour work being comparatively uncommon; soap, dental preparations, mouthwashes, colognes and after-shave lotions are among the main products in which the oil is employed. World consumption of origanum oil appears to be considerably lower than it once was, although there is no obvious prospect of a further decline from current consumption levels.

Thyme oil – Thyme oil is distilled from the herbs *Thymus vulgaris* and *Thymus zygis,* which are very similar and which yield an oil containing predominantly the phenol thymol. Crude thyme oil is generally known as red thyme oil, but there also exists white thyme oil which can be either a redistillate of the red thyme oil or, more commonly, a somewhat arbitrary mixture of a number of independently derived compounds with some crude or redistilled red thyme oil. No herb exists which yields the commercial white thyme oil at the first distillation. Thyme is of course a well-known culinary herb, and it is widely cultivated as such, but it is the wild growing, although otherwise identical, plant which is distilled, as it is uneconomic to cultivate the plant for distillation alone. The plant grows abundantly throughout Europe, North Africa, the Middle East and Asia Minor, although production of thyme oil nowadays is mainly restricted to the Almeria province of Spain. Possibly a little is produced in Morocco and Turkey, but these countries are not regular exporters. France regularly re-exports the oil and offers redistilled thyme oils to the world markets, but is no longer a producer of any significance. World production is of the order of 20 to 30 tonnes per annum, much of which enters international trade. Thyme oil has also declined in importance during the past 20 years, mainly on account of the increasing encroachment of synthetic thymol into the market. This trend has flattened out noticeably but a slight decline is still apparent, and it is worth noting that recent emigration from the producing areas in the Almeria province of Spain has virtually ruled out any possibility of a resurgence of production, even if demand were to turn upwards again.

The thymol content of thyme oils varies between 20 and 60 per cent, or slightly over, and it is normally that type of white thyme oil which consists simply of redistilled red thyme oil which contains the very highest percentage of thymol. Red thyme oil is used in flavouring sausages, packed and canned meats, and certain types of sauce, and in medium-grade and low-grade perfumery, especially for soaps and detergents. It possesses germicidal properties and, in spite of the existence of synthetic thymol, is still used in various pharmaceutical preparations for treatment of coughs. White thyme oil is more likely to be used in higher class perfumery or in applications where a precise formulation is needed.

A rather similar oil, known as ajowan oil and distilled mainly in India from the plant *Ptychotis ajowan,* used to appear at irregular intervals as an adulterant for European thyme oils, but although this oil is still produced in India and one or two other countries, it is seldom if ever exported and as far as the main markets are concerned is totally insignificant.

Wild thyme oil – This is an unimportant and declining oil in comparison with others already discussed. It is distilled from the plant *Thymus serpyllum*, widely referred to as the French word 'serpolet' and better known as a minor culinary herb. Production takes place in Albania and maybe one or two other countries in that area of Southern Europe, but amounts to no more than 100 to 200 kg annually. It is used as a food condiment and in one or two perfumery applications. It should not be confused with origanum oil, which is sometimes erroneously known as wild thyme oil, or with true thyme oil, in spite of the fact that the latter is distilled from wild thyme only in the sense that the plant is not cultivated. The oil from *T. serpyllum* differs from both these oils and, as already noted, is of far less importance than either.

Oleoresins – These are manufactured from *Origanum majorana, Thymus masticina, Thymus capitatus* and *Thymus vulgaris* (or *T. zygis*) and correspond to the equivalent oils. These oleoresins are used mainly in the food and flavouring industries and in all cases are likely to have affected the markets for the essential oils. In the late 1960s and early 1970s the development and increasing use of the oleoresins almost certainly had a noticeable effect on demand for the oils, but this trend appears to have spent itself and at the time this report was being written the two types of product complemented each other rather than competed. In the case of the oils of marjoram and thyme there also exists a range of special tinctures and 'absolute' extracts which have their own special uses, for example in vermouths and bitters where marjoram is concerned. These products do not impinge on the market for the essential oils as they are used in only very small quantities, and reference to them is only made for the sake of completeness.

In the sections which follow rather general treatment has had to be given to the products described above, since detailed information is either unavailable or unreliable on account of the problems of nomenclature. Certainly, the published statistics are prone to serious errors of classification. Of the above oils, only those of wild marjoram and thyme are given appreciable coverage in the literature, but even here the reliability of the information can be open to doubt. Very many dealers, brokers and processing houses seem genuinely unsure of the exact nature of the product under discussion, although this may be because to some extent some of these oils are interchangeable in the somewhat undemanding uses to which many of them are put.

PRODUCTION AND TRADE

Estimates of total world production of each of the oils under discussion have been given above and will not be repeated here. The more important of the oils under discussion are mainly exported from their countries of origin, only relatively small proportions of total production being consumed at source. The nature and direction of international trade will now briefly be discussed.

Sweet marjoram oil is exported to a wide range of destinations from all the exporting countries, with the possible exception of Tunisia, from where a large proportion of the oil appears to be shipped to France, and then subsequently re-exported. Wild marjoram oil is exported from Spain to many countries but the main destinations appear to be the USA and the UK. There is also trade between non-producing countries, as with many essential oils, as the efficient international network of dealers and processors adjusts the deployment of supplies to take account of shifts in demand.

No information is available on world trade in oregano oil, but it is likely that a much greater proportion of the oil produced is consumed at origin than is the case with the other oils, particularly where Italy, the main consuming country, is concerned. Exports of origanum oil are recorded only for Spain and the largest buyers are the USA and the UK, although again widespread dealer-to-dealer and dealer-to-processor trading takes place across international borders.

Thyme oil exports are recorded for Spain only. The USA regularly takes about one-third of Spanish exports, followed in order of importance by the UK, Switzerland and France, the latter re-exporting appreciable quantities of oil. Roughly equal quantities are taken by West Germany, the Netherlands and Italy. Small quantities of a few hundred kilograms or less are taken by a very wide range of countries on all continents. No information is available on the export of wild thyme oil as defined in the previous section, but the quantities are in any case extremely small.

MARKETS

Information on the markets for these oils is very sketchy, and in the case of sweet marjoram oil, oregano oil and wild thyme oil is generally not available at all. Therefore, only a very broad picture can be given.

The United States of America

The current level of consumption in the USA is about 1 tonne of wild marjoram oil, 1 to 2 tonnes of origanum oil and up to 10 tonnes of thyme oil per annum. Consumption is in all cases steady and not likely to increase appreciably, although some buyers were of the opinion that the new Food and Drug Administration restrictions on the use of various ingredients in toothpaste and mouthwashes may help to arrest any decline in the market for natural flavouring oils such as those of sweet marjoram and thyme.

Sweet marjoram oil is used in only small quantities in the USA, its main applications being the flavouring of toothpastes and mouthwash preparations and the perfuming of shampoos, whereas uses for wild marjoram oil include the flavouring of sauces, sausages and other meats. Thyme oil is used in some pharmaceutical products such as cough sweets and syrups and preparations for the treatment of colds, and also in the flavourings of various food products. Origanum oil's uses are rather similar to those of thyme oil, although less is used by the food industry, and unfortunately it is difficult to identify user criteria for the use of one oil rather than the other. The existence of inexpensive synthetic thymol effectively precludes the likelihood of any increase in demand for thyme oil, and although the marjoram oils are being used increasingly in herbal toiletries the overall demand for them is not likely to increase noticeably.

The United Kingdom

In relation to its size, the United Kingdom is a fairly large market for the oils of marjoram and thyme and their relatives, though not an expanding one. Of the order of 5 tonnes of thyme oil, 0.5 to 1 tonne of origanum oil and 0.5 to 1 tonne of wild marjoram oil are used annually, also comparatively large quantities of sweet marjoram oil. Very small quantities of the more important oils are distilled locally by a major processor. Origanum oil is imported from the Middle East as well as from Spain, and its uses are restricted mainly to fragrance work. The overall pattern of usage closely resembles that described in the introductory paragraphs (p. 23).

West Germany

Although in the West German food industry the marjoram flavour is imported more as the oleoresin than the essential oil, there is nonetheless a market for 2 to 3 tonnes of wild marjoram oil in West Germany. It is used both in the traditional German sausage products and as a flavour for soups and canned meats, a little also being used in perfumery and pharmacy. A quite widespread practice is to blend it with the oils of sage and spike lavender, and one user indicated that it is sometimes used in the same manner as basil oil. Wild marjoram oil is imported from most of the recorded exporters. Sweet marjoram oil is also used but in extremely limited quantities and mainly in flavouring. Origanum oil is not used to the same extent and the little that is used is divided equally between the perfumery and flavouring industries. Red thyme oil, unlike white thyme oil, is a fairly important item in West Germany and some 5 tonnes are used annually in pharmaceutical products, bath preparations and a few food uses, but usage is not increasing, especially as synthetic thymol is well established in the market.

France

Both types of marjoram oil are well known in France, and in particular the low-volume sweet marjoram oil is imported in large quantities in relation to world production. As well as Tunisian oil, some quantity of the herb is imported from Tunisia for distillation into a very high quality product in the Grasse factories. No information has been forthcoming on the usage of wild marjoram oil, but it is certainly imported both from Spain and from the African continent. France was one of the very few countries where oregano oil was mentioned as being in use, although only in small quantities; surprisingly, it is used in perfumery as well as in flavouring, although this is unlikely to be the case outside France. It is imported from Italy. Origanum oil is not widely used in France, and although 1 tonne was imported in 1976 the normal annual intake is of the order of 100 to 300 kg. Red thyme oil is imported from Spain and China in fairly large quantities, maybe around 5 tonnes per annum, for use in meat preparations and for the extraction of natural thymol.

The Netherlands

Dutch usage of the oils under discussion seems to follow the general pattern elsewhere although few details were forthcoming. The annual market for the oils of marjoram does not exceed 1 to 1.5 tonnes. The oils of oregano and origanum are imported from Italy and Spain respectively, but in quantities of a few hundred kilograms per annum only. White thyme oil is imported much more extensively than red thyme oil, but it is not known whether the imported oil is a redistillate or a blend of various ingredients. Thyme oil is used in the perfuming of soaps, cosmetics and detergents and although it is regarded as a somewhat crude, unrefined flavouring material, up to 5 tonnes per annum are used.

Other markets

Japanese imports of the marjoram oils have only been recorded intermittently, and do not appear to exceed 1 tonne per annum; indeed the average figure may be much less. About 1 tonne of thyme oil is imported each year, mainly from France, the USA, the UK and the Netherlands rather than from the producing countries. The oils of wild marjoram, origanum and thyme are imported by a very large number of other countries, a surprising number of which import direct from the producing countries rather than from dealers in London, New York, Hamburg and Rotterdam.

Market structure

The usual network of dealers, export and import agents and processing houses is employed for the marketing of the oils under review, and there are no special marketing arrangements which set the market structures applicable to those oils in any way apart from the basic structures described in the Introduction (p. 11).

PRICES

Recent price movements for the oils of marjoram, origanum and thyme are given in Appendix A, Tables 3, 4 and 5 respectively. Current price levels are giving rise to a certain amount of anxiety in the trade. The only possible reason for the recent increases is that many of the Spanish producers are moving to more lucrative occupations and the supply situation, even if not critical, may be tightening to the point at which a sellers' market is beginning to emerge. However, it is rather doubtful whether the present level of demand can be sustained in the long term in the face of these price levels, and it may be that a substantial realignment of price levels, supply and demand may be required before a position of long-term stability can be achieved. This is further discussed in the next section.

It will be noticed that the price of white thyme oil is lower than that of red thyme oil. From this it has been concluded that the type of white thyme oil to which these statistics refer is a mixture of inexpensive ingredients rather than a redistillate of red thyme oil, since the latter could hardly be cheaper than crude red thyme oil.

It should also be noted that sweet marjoram oil is extremely expensive in comparison with wild marjoram oil. This is mainly because the sweet marjoram used for distillation is cultivated rather than wild. Unfortunately the published statistics for sweet marjoram oil do not always indicate the country of origin.

In the early months of 1978 the current price quotations were as follows:

Sweet marjoram oil, Hungarian (cultivated)	£43.50/kg (spot, London);
Wild marjoram oil, Spanish	£8.60/kg (spot, London);
Marjoram oil, Egyptian	£18.90/kg (spot, London);
Origanum oil, Spanish (70% carvacrol)	£12.00/kg (spot, London);
Origanum oil, Spanish	£12.15/kg (f.o.b. New York);
Thyme oil, red (45–55% thymol)	£10.50/kg (spot, London);
Thyme oil, white (25% thymol)	£5.70/kg (shipment);
Thyme oil, white (45–50% thymol)	£11.00/kg (spot, London);
Thyme oil, red (National Formulary)	£8.70/kg (f.o.b. New York);
Thyme oil, white (National Formulary)	£8.00/kg (f.o.b. New York).

PROSPECTS

The oils of sweet marjoram (*Majorana hortensis*), oregano (*Origanum vulgare*) and wild thyme (*Thymus serpyllum*) may be dismissed as far as a discussion of the prospects for new producers is concerned, since they are insufficiently important in volume terms. As far as the remaining oils, namely those from species of wild marjoram (*Thymus masticina*), origanum (*T. capitatus*) and thyme (*T. vulgaris, T. zygis*) are concerned, it must be said at the outset that no reduction in price, however great, could induce an appreciable and long-term upturn in demand. While it is true that the oleoresin trend has largely spent itself, demand for wild marjoram oil and origanum oil is likely to remain at roughly the present level while the signs suggest that the market for thyme oil, which has already declined substantially from former levels, may continue to diminish slowly before a plateau is reached. There are therefore no major opportunities for prospective new producers, and such opportunities as may develop in future are likely to arise only from undue contractions in the levels of supply, principally in Spain. However, unless price levels below those currently ruling are sufficient to staunch the drift of Spanish growers into other occupations, (and although the long-term trends in this respect are not yet clear, the outlook is not promising) there may be a need in the medium term for new suppliers. These will inevitably be restricted to countries where marjoram, origanum and thyme already grow wild in abundance, since cultivation of the plants would be uneconomic. Equally the quality and characteristics of any new oils will have to correspond closely with those already available. At the same time it should be noted that there are already one or two countries, notably Egypt, which are attempting to enter the market for these oils on a major scale, especially marjoram, and much may

depend on the success or failure of these ventures. As in all cases, preliminary consultations between prospective producers and the main buyers provide the soundest and safest basis for a decision on whether it is worth entering the market. In conclusion, although the outlook is uncertain for the three major oils in the group, the prospects for new entrants do not appear *prima facie* to be hopeless.

Sage

INTRODUCTION

The two sage oils of commerce are the Dalmatian and Spanish types. Clary sage oil, although in some respects related to the true sage oils, insofar as it is distilled from another species of the *Salvia* genus, is nonetheless a quite distinct product. The production and marketing of clary sage oil is, and has been, dominated to such an extent by the USSR that attempts by other countries to acquire a share of the market have seldom met with any degree of lasting success, although a small amount of specialised production takes place in France and to an even smaller extent in one or two other Western European countries. As it is furthermore not suitable for production outside temperate regions, it is not considered worthy of detailed discussion in the context of this report, and only passing reference will be made of it.

Dalmatian sage oil is steam-distilled from the dried leaves of wild *Salvia officinalis.* This plant grows in abundance on the Yugoslav mainland, on the Dalmatian islands, in Albania, Bulgaria, Turkey and other countries in South-eastern Europe and Asia Minor. It also occurs in Western Europe, although less widely, and on the Mediterranean islands. Yugoslavia has traditionally been the main producer of the oil, although it is evident that Albania is also of considerable importance. Smaller and less regular quantities are produced in Bulgaria, Turkey, Lebanon and France. West Germany and the UK occasionally produce the oil in small quantities, although to a very high standard of quality, and Morocco has been known to offer a closely related oil distilled from *Salvia maurorum.* Malta and Cyprus, although known to have produced the oil at one time, are no longer producers of significance. Spanish sage oil is steam-distilled from the wild herb *Salvia lavandulaefolia,* found widely throughout the Iberian peninsula and southern France, and also in Morocco. A closely-related oil known as Greek sage oil is distilled from the *Salvia triloba* plant in Greece and Asia Minor, but appears not to be widely known outside the producing countries.

Although Dalmatian sage oil is often said to be the superior of the two oils in terms of quality, they are sufficiently distinct in their characteristics not to be readily mutually substitutable, and there are many users who find the Spanish oil preferable. The odour of Dalmatian oil owes much of its character to the ketonic constituent thujone, which accounts for at least 50 per cent of the constituents in the best oils. In the Spanish oil the thujone content is much lower and the odour is distinctly different. Broadly speaking, Dalmatian oil is used for flavouring a range of cured meats, canned meats, condiments, seasonings, pickles, baked goods, liqueurs, bitters and even mouthwashes; while Spanish oil is used largely in perfumery, most particularly for the scenting of soap. However, it is certainly not unknown for Spanish oil to be used for flavouring, nor Dalmatian oil for perfumery applications.

PRODUCTION AND TRADE

The available published statistics and the information provided by traders in and users of the sage oils both fail to present a completely clear picture of the magnitude of

production and trade. In every instance the trade figures are incomplete, and in some cases unreliable. In the case of Dalmatian oil, it seems very likely that there is at least some consumption at source, and also that there may be significant unrecorded trade with the northern Comecon countries, including the USSR. However, it seems most likely on balance that annual average production of Dalmatian oil is of the order of 7 to 15 tonnes, of which Yugoslavia and Albania each account for 35 to 45 per cent and France 10 to 20 per cent, the balance being attributable to other Western European and Mediterranean countries. Most of Albania's exports are routed to or through Yugoslavia, while French production is mainly for domestic use. The main destinations for Yugoslav exports and re-exports are the USA, the UK, West Germany, Austria, the Netherlands and France – in approximate order of importance, although there is some variation from year to year. There has been no discernible trend in either production or trade, although there were peaks in 1973 and 1974, probably as a result of speculation in view of the commodity boom of that period, and also recent shortages, possibly on account of production cutbacks which occurred as a result of price falls following the boom.

Spanish sage oil has been marketed in rather steadier quantities than has the Dalmatian oil. Between 1968 and 1974 annual exports varied around an average of 14 tonnes, with a high point of 18 tonnes in 1972 and a low of 10 tonnes in 1973. Total production of the oil may be close to an annual average of 20 tonnes, allowing for some consumption of domestic production in Spain and a little production elsewhere, for example, in southern France. Spain usually dominates the export market, other exporters, such as Morocco, being generally insignificant. The USA, France and West Germany have each recently imported an annual average of about 3.5 tonnes of Spanish oil, while the UK has taken less than 2 tonnes and the Netherlands less than 1 tonne, although before 1970 the average imports into the last two countries were higher. On a world-wide basis trade in Spanish oil, like trade in Dalmatian oil, exhibits neither an increasing nor a decreasing trend, but in relation to rising incomes and industrial output the real trend would seem to be downwards, and it is quite possible that an actual decline may begin to become apparent as labourers move into more profitable occupations.

Somewhat to the detriment of the reputation of the sage oils, instances have been reported of adulteration of either type with the other, a practice which seems to occur both in Spain and in Yugoslavia. One or two buyers are content with such hybrids, but most have a definite preference for one type or the other. There have also been instances of adulteration of Spanish sage oil with, for example, rosemary oil.

By way of contrast only, world production – which to all intents and purposes means USSR production – of clary sage oil is of the order of 100 tonnes per annum, by far the greater part of which is exported. There is little evidence, however, that the movements in the clary sage oil market over the years have ever brought about any undue repercussions in the market for the Dalmatian and Spanish sage oils, thus indicating that the product is quite distinct in its characteristics and applications.

MARKETS

The United States of America

Roughly equal quantities of Dalmatian and Spanish sage oils are imported annually into the USA, probably totalling about 7 to 8 tonnes per annum, in most cases via dealers or agents. The Dalmatian oil is used mainly in flavour work, particularly in certain meat products such as pork sausages, for which the oil's aroma is eminently suitable, and also in poultry seasonings. The Spanish oil, which one dealer believed to have been produced sometimes in Morocco, is generally used in perfumery, both in perfumes as such and to impart a herbal fragrance to a range of toilet soaps. In spite of fashion swings, the fluctuations in usage tend to be reflected in variations in stock levels rather than in imports. The US market for sage oil is stable and

secure, although if there is a future increase in consumption it is unlikely to be more than slight. Recent shortages brought about by successive European droughts have caused concern among US buyers, Dalmatian sage oil in particular having been in very tight supply. It is too early, however, to give an indication as to whether the price will eventually stabilise at a level which maintains the interest of producers and users alike.

Sage oleoresin is one of the more important oleoresins used by the US food industry. It is used in applications similar to those of the Dalmatian oil, and hence is produced from Dalmatian rather than Spanish raw material. The markets for the oil and for the oleoresin are complementary and do not impinge on each other.

Western Europe

The main market for the sage oils in Europe is West Germany. Reported annual usage there is of the order of 8 to 12 tonnes, from which it must be concluded that West Germany either imports from sources other than Yugoslavia and Spain – very probably France – or produces some of its own requirements, or maybe both. The Spanish oil accounts for two-thirds of German usage, but since the Dalmatian oil is increasing in popularity this proportion is expected to decrease. The sage oils are used both as distinct flavouring and perfumery materials in their own right and as part of a range of formulations embodying a wide range of herbal notes. In Western Europe, Dalmatian oil is used proportionately rather more in perfumery and pharmaceutical preparations than in the USA, although it is probably still true that the greater part is used in flavouring, mainly in the German meat and sausage industries. Of all the Western European markets for the sage oils, the West German is the most buoyant and a small long-term increase in usage can be expected. The oil is imported mainly via dealers in Hamburg. Very small quantities of Dalmatian sage oleoresin are also used in West Germany, in both flavouring and pharmacy.

The other Western European markets appear to be both small and, if anything, in decline. In the United Kingdom annual usage is now under 2 tonnes, and in the Netherlands it is barely 1 tonne. It proved difficult to ascertain the precise area of usage in either country, but the preference for Dalmatian oil in flavour work and Spanish oil in perfumery has been found to hold in both cases. The Spanish oil is used in greater quantities than Dalmatian oil. On the whole, the sage oils were found to be blended with a wide range of other herbal and spicy materials before they finally found their way into end-products.

In France it would appear that recent annual consumption has been of the order of 3 to 5 tonnes, in spite of one or two claims of annual consumption of ten times that figure. Most of France's imports consist of Spanish sage oil. There is also some local production of the Dalmatian type, particularly in the Provence region. The Spanish oil is used, as elsewhere, in the perfume compounding industry. The Dalmatian oil is used for both the isolation of thujone for use in soap, and in certain pharmaceutical preparations; it is less used in ordinary food flavouring applications in comparison with other countries. One Grasse compounder believed that in the long term the market for Dalmatian sage oil would decline, whilst that for clary sage oil would increase. Generally speaking, the French market was not observed to be expanding and it is unlikely that French demand for either of the sage oils will increase.

In the UK, the Netherlands and France the dealer proved once again to be dominant in the sage oil trade, although one or two flavour houses, particularly in Grasse, appear to purchase direct.

Other markets

Japan is a negligible user of sage oil, as is Switzerland, neither country consuming more than a few hundred kilograms annually. It is evident from the trade statistics, however, that Yugoslavia imports between 500 kg and 1 tonne each year from Western Europe. It is clear that the sage oil aroma is popular in local savoury and perfumery preparations, and that Yugoslavia regularly exports a higher proportion

of local production than would normally be surplus to local requirements. No information on other markets was forthcoming, although, with the possible exception of Spain, all are of minimal importance.

PRICES

Table 6 of Appendix A illustrates the way in which sage oil prices have moved over the past 11 years. The considerable esteem in which the Dalmatian oil is held is reflected in the price differential *vis-à-vis* Spanish oil, although the difference has sometimes been below 25 per cent.

Low prices following the collapse of the 1974 boom into the world recession markedly depressed prices of the sage oils, with an apparently increasingly serious effect on production levels. The effect, however, was not felt until re-stocking began in earnest. As this re-stocking coincided with the 1976 European drought, prices were given a sharp upward impetus, and the dry 1977 summer did nothing to contain this rise. At present, buyers are anxious to obtain the Dalmatian oil at any price, although the Spanish oil may have risen above the safe limit. Speculation appears to be a prominent feature of the current market situation, but in the longer term users are certain to insist upon a return to price levels rather closer to those of the pre-boom days if they are to continue purchasing the oils in the usual quantities. Too sharp a price fall, on the other hand, would discourage growers, many of whom have already shown signs of loss of interest in the oil.

Recent quotations were as follows:

Dalmatian sage oil	£18.20/kg spot (New York);
Spanish sage oil	£10.50/kg spot (New York);
English-distilled sage oil	£52/kg (c.i.f. UK).

The English-distilled oil has been at the above-quoted price level for four years, a fact which reflects its exceptional quality. However, the range of uses in which an oil of this quality is needed is very limited.

PROSPECTS

The precise extent to which a new producer can break into the market for sage oil will depend in part on the degree to which supplies of Dalmatian oil recover from their present depressed level, and in part on the ability of prospective producers to deliver the quality and characteristics required by the trade. It is doubtful whether there is any need for additional supplies of Spanish sage oil and the field is therefore limited to Dalmatian-type oil. Like most herbs and herbaceous oils, sage is best grown in comparatively temperate areas, which means, where the tropics and sub-tropics are concerned, in upland regions with suitable soils. Careful choice of planting material is of course of the utmost importance. However, it is unlikely to become clear for a year or so how far the fall in production of the Dalmatian oil is permanent, and it would be as well if decisions on production in new locations were deferred until the medium- and longer-term trends become clearer.

Sage oleoresin can be regarded as having a favourable future, but, as with other small-volume oleoresins, production at source is not recommended. Herb oleoresins are technically difficult to produce and only companies with advanced technological processing facilities are in a position to undertake the task.

Celery

INTRODUCTION

Two essential oils are distilled from the celery plant *Apium graveolens*, namely celery herb oil and celery seed oil. The former is distilled from the entire plant and is a true herbaceous oil, but its commercial importance is very small. The latter is distilled only from the seeds or fruits of the plant, as its name implies; it is therefore not strictly speaking a herbaceous oil, but its uses are similar to those of many herbaceous oils and, in any case, it would not be feasible to study celery herb oil in isolation from its close relative. Celery seed oil is much better known and of far greater commercial importance than celery herb oil, which has a fresher character but is of lower strength.

Celery seed oil is produced mainly in France, India, the USA and the UK. Other, less important, producers include Hungary, China, the Netherlands, Spain and Italy. Much of the seed which is eventually used for distillation originates in India, although small quantities are grown in France, Spain and Italy for local distillation. Data on celery herb oil production are not available, but it is almost certain that this oil is produced mainly in Eastern Europe, notably Hungary, although France may also produce very small quantities.

The major outlet for celery seed oil is the flavour industry. Of the various savoury products in which it is used, soups are easily the most important, other uses including meats, pickles, sauces and various vegetable-based products. Celery is an important flavouring material in its own right, and consequently its demand is less price-elastic than is the demand for many other oils which could if necessary be omitted from formulations, or for which there are adequate substitutes. The oil is also used in perfumery in a wide range of products, but invariably in extremely small quantities; if used very sparingly, it imparts a pleasant warm note, but the slightest excess can easily ruin a perfume. The pharmaceutical industry is also a user of the oil, but only in a very narrow range of products, and the quantities involved are virtually negligible and are decreasing.

The oils of celery are in a minority among herbaceous essential oils insofar as their market status is substantially influenced by the existence of a corresponding oleoresin. Celery seed oleoresin is extracted from the seed in the usual manner by means of a solvent, such as hexane, and it is now a product of greater importance than the essential oils. Most oleoresins compete more directly with the ground spice or seed than with the comparable essential oil. Although this is true of celery, there is no doubt that the growth of the celery seed oil market would have been much greater but for the considerable growth of the celery seed oleoresin market. During the 1960s celery seed oleoresin steadily replaced both the seed and the essential oils over a range of flavour applications, mainly because of the better solubilisation and flavour retention properties of the oleoresin compared with the essential oil in food applications. There is no likelihood of any reverse switch in future, although the trend has now slowed down sharply as the limits of substitution are being reached, and it would be more true to say that the essential oils and the oleoresin now com-

plement one another rather than compete. One estimate of annual world production of celery oleoresin – a large proportion of which takes place in the USA – was 50 to 100 tonnes, but it is very probable that the true figure is in excess of 100 tonnes. Very small quantities of specialised celery tinctures or extracts are also produced, but the existence of these hardly impinges on the markets for the oils at all.

PRODUCTION AND TRADE

Annual world production of celery seed oil is hard to estimate with accuracy on account of the very large gaps in the published data, but the available evidence suggests that it falls within the range of 15 to 40 tonnes. While the French and Indian oils are perhaps the best-known in international trade, the USA probably produces as much as any other country, although mainly for its own internal requirements. Although trade estimates differed, such consensus as emerged indicated that world production is apportioned roughly as follows: the USA and France each 30 to 40 per cent; the UK 5 to 10 per cent; India, the Netherlands and Eastern Europe each around 5 per cent; all others up to 10 per cent in total. As already mentioned, celery herb oil production appears to take place mainly in Eastern Europe.

A large proportion of the celery seed oil produced throughout the world is distilled from Indian seed; even in the USA most of the raw material has to be imported. Only the Western European producing countries, notably France, distil any appreciable proportion of their requirements from locally-grown seed.

The USA imports from France and India, mainly the former, that part of its requirements of celery seed oil which it does not produce itself. France is the most important net exporter of celery seed oil, and most other European countries buy oil from her, as well as smaller quantities from India. Indian production has never been great and, although it is thought to have increased slightly in recent years, it has a reputation for being unreliable. It is also interesting to note that India is now a producer and exporter of celery seed oleoresin, although not comparable in importance with the USA or UK in this field. UK-distilled celery seed oil is of high quality, and is exported to a number of countries, including the USA, but the quantities are relatively small.

Production of celery herb oil does not amount to more than 1 tonne per annum and trade in this oil may be of even smaller magnitude. It is exported from Eastern Europe to widespread destinations, including the USA, no one country importing more than a few kilograms of it at a time.

The oils are traded through the usual network of export and import agents and dealers; Eastern European exports normally being channelled through the sole export agency in the country concerned.

MARKETS

The United States of America

The market for celery seed oil in the USA is of the order of 5 to 10 tonnes per annum, and for celery herb oil, a few hundred kilograms at the most. It should be appreciated that these and other estimates may be subject to some error on account of the scarcity of information, but the order of magnitude is almost certainly correct. As already mentioned, the greater part of the total quantity of celery seed oil, though not the herb oil, distilled in the USA is from imported seed which originates mainly in India, smaller quantities of seed being imported from France and Indonesia. The bulk is used in canned soups, although in smaller quantities than, say, ten years ago on account of the rapid spread in the use of the oleoresin. Other outlets are canned products based on the tomato flavour, pickles, and certain types of perfume, where the oil, if used in small quantities, imparts a

subtle warmth. The herb oil may well be used relatively more in perfumery than in flavouring, but the quantities are extremely small. The US market for the oils of celery is now fairly stable.

Western Europe

The West German market for the oils of celery is of the order of 2 to 3 tonnes per annum. Most of this market is accounted for by celery seed oil, as would be expected, but it is also quite possible that West Germany uses a fairly large proportion of the world production of celery herb oil. India, France and China are the most commonly recorded suppliers of celery seed oil to the West German market; celery herb oil comes mainly from Eastern Europe, and although consignments from France have been recorded it is possible that these were actually of Hungarian origin. As in the USA, soups are the main outlet, but again the oleoresin has to some extent taken over in this field. Various sauces, pickles, and meat and savoury products also incorporate the oil, and in addition it is used by the larger perfume houses for the preparation of aromatic compounds.

The United Kingdom market for the celery oils is of the order of 2 to 3 tonnes. It is not possible to indicate the proportion of this total that is attributable to UK-distilled oil, but it appears to be fairly high. Certainly imports from France, China and India have never appeared to be great on those occasions when records have been kept. The high-quality UK-distilled oil, which is produced by one or two companies only, is used in best quality soups and meat products such as sausages, and in certain types of perfume, including those with a jasmin-rich character. It has also been used in very small quantities as an aromatic ingredient in some high-quality tobaccos. The imported oils are used in rather lower quality soups, pickles and vegetable products, and very small quantities are still employed in pharmacy. Celery herb oil is little known in the UK.

In light of the fairly extensive local distillation of the seed oil the French market is smaller than might be imagined, and may not be more than 3 tonnes per annum. A large proportion of locally-distilled oil is exported, and it is of fairly high quality. In contrast with other countries, as much as 60 to 80 per cent of locally-used oil is absorbed by perfume houses, the balance being destined for the canned food industry and for use in convenience foods. As in the UK, the herb oil is not widely known and is little used.

Less than 1 tonne of the oils of celery is consumed annually in the Netherlands. The nature of usage resembles that of the UK rather than France, that is to say, the oils are used mainly for flavouring soups and various meat and vegetable preparations, with smaller quantities used as fortifiers in perfumery. Usage of the oils is increasing slightly, but the widespread use of the oleoresin is certain to have the effect of limiting the growth of the market.

No other Western European markets of special note exist, although many countries use annual quantities of a few hundred kilograms.

Other markets

From only one other market was information obtained, namely Japan. Consumption there is of the order of 1 to 3 tonnes per annum, and is stable. From the few opinions that were expressed it would appear that usage is divided almost evenly between the flavour and cosmetics industries.

PRICES

Information on recent price movements relating to the oils of celery are given in Table 7, Appendix A. Unfortunately regular quotations for Indian oil were not continued after 1974, although a recent isolated quotation suggests that it may not have changed much during the past three years. There is no ready explanation as to why prices of French oil should have cheapened while UK-distilled oil has become

more expensive, but it is worth noting that a very recent quotation for French oil suggests that a sharp upturn has occurred. The quotations for Indian oil and for another oil of unspecified origin (possibly Eastern European) given in Table 7, Appendix A suggest that the UK and French oils enjoy a considerable price premium over their counterparts, mainly on account of quality. At present there is no marked trade disquiet over current price levels, although, while the price-elasticity of demand is relatively low for reasons discussed earlier, the market for celery-based products would probably eventually begin to decline in relative terms if excessively high oil prices were to be reflected noticeably in the prices of end-products.

At the time of writing the ruling price quotations were as follows:

Celery seed oil (English)	£45/kg spot;
Celery seed oil (French)	£41/kg spot;
Celery seed oil (US)	£46/kg (US dealer).

PROSPECTS

There is no obvious prospect of any permanent cutback in Indian production of celery seed, and distillers can therefore continue to rely on India as their primary source of raw material. Only in the event of very excessive price increases, whether necessitated by increases in the distillers' costs of production or not, is there likely to be any detectable downward pressure on levels of usage. There is no apparent tendency for the existing distillers to move out of celery seed oil into other products, and in consequence there is no prospect of supply falling seriously behind demand in the immediate future, and world demand is in any case unlikely to increase appreciably. However, since the oil is certainly not in a state of over-supply, there may in the medium term and beyond be a little potential for new entrants to the celery seed oil market, although not to the herb oil market. Celery is a plant which grows or can be cultivated easily within fairly wide climatic limits. But as always, it will be advisable for potential producers to embark upon production only after appropriate consultations with individuals in the trade, with a view to reaching agreement on quality, size and frequency of consignment, and on contract procedures.

In conclusion, while there is at present no positive demand for new sources of supply of celery seed oil, it is probable that new sources would be welcomed, especially with any irregularity in the Indian supplies. Now that the trend in favour of the oleoresin has been largely expended, it is possible to take a rather more optimistic view of the future of the celery seed oil than one might have done a few years ago. On the other hand, the very small usage of celery herb oil does not make it a good prospect for a new producer.

Fennel

INTRODUCTION

The oils of fennel are basically categorised as bitter and sweet. Three oils are known, two within the former category and one in the latter, but nowadays only one of the bitter oils is of commercial importance.

One bitter oil is the only truly herbaceous oil of fennel, and this is steam-distilled from the wild-growing strains of the herb *Foeniculum vulgare* var. *vulgare,* which occurs widely in south-western Europe and north-west Africa. Unlike the other oils of fennel, this oil is obtained from most of the upper parts of the plant. In the days when this oil was of importance it was used largely as an odour mask where unpleasant aromas had to be mitigated. Although Arctander* in 1960 estimated annual world production to be of the order of 10 tonnes, it appears that production is now of negligible proportions and that the oil has been superseded.

The bitter fennel oil of present-day commerce differs from the above oil in two important respects. Although the plant from which it originates is basically the same as that described above, only cultivated strains are used, and it is only the seeds or fruits, rather than the green upper parts, which are distilled. In the latter respect the oil could more truly be described as a spice seed oil rather than a herbaceous oil, but traditionally both it and sweet fennel oil – also a seed oil – have been more closely associated with herbaceous oils than with spice oils. Arctander's estimate for world production of this oil in 1960 was 25 to 75 tonnes, but for the present day this would be a considerable over-estimate, 10 to 25 tonnes being a more realistic range.

Sweet fennel oil is distilled from *F. vulgare* var. *dulce,* which is a very close relative of the bitter fennel herb. It is mainly a cultivated herb; only infrequently is it found in the wild, and then it is not usual to exploit it. The importance of this oil is only a small fraction of what it once was. Whilst the estimate of 500 tonnes as the level of annual production in France alone, when its popularity was at its peak, is probably an over-estimate, it is quite possible that current world production of this oil is not even as great as that of bitter fennel oil. A very approximate estimate would be 10 to 20 tonnes.

An analysis of production, trade and markets in relation to the oils of fennel is hindered by the fact that the published information frequently does not distinguish between the bitter and sweet oils. Even dealers and processors are sometimes vague regarding the source of each type of oil. However, it would appear from the available evidence that the producers of bitter fennel oil include West Germany, Spain, France, Hungary, India and China, and of these the first two appear to be dominant. Italy may also be a producer, but it is more likely that it is only the sweet oil which is produced there. The oil of sweet fennel is produced mainly in Spain, France, Morocco and Italy, and the evidence strongly suggests that Spain dominates the export market.

* Arctander, S. (1960) *Perfume and flavor materials of natural origin.* New Jersey, USA: Elizabeth, 736 pp.

The main characteristic of the oils of fennel, which to a large extent determines the range of uses to which they are put, is the high content of the phenol ether anethole. This compound is the basis of the anise or liquorice types of flavour, and in consequence the oils are used in a range of liqueurs, confectionery and pharmaceutical products such as cough sweets, and other products where this flavour is popular. At the same time, however, it must be stressed that the oils of anise (*Pimpinella anisum*) and star anise (*Illicium verum*), the latter in particular, are preferred as natural sources of this type of flavour; the fennel oils nowadays are only used when price or supply problems are experienced with the other oils. Furthermore, anethole can now be readily synthesised and is quite widely produced. These are the main factors behind the historic decline in the importance of the fennel oils, and they also account for the somewhat erratic nature of demand.

Commercial bitter fennel seed oil is used widely throughout Europe. As well as being used in food products and liqueurs, it is used in some undemanding perfumery applications, notably in the preparation of domestic and industrial aerosols and insecticides, in which its pleasant odour effectively masks the less pleasant odours of certain active ingredients. It possesses medicinal properties in its own right and is used in some carminative preparations and in stimulants. It has also been known to have been used for imparting a mild flavour to tobacco. Some minor food applications include baked goods, dairy products and soft drinks.

Sweet fennel oil used to be extremely popular for its aniseed flavour, but, as already noted, this flavour is now imparted in other ways. There are still applications in the liqueur and confectionery fields in which it is the preferred material, as is the case with bitter fennel oil, and in particular certain types of candy incorporate the product. These applications, however, are comparatively few and are unlikely to increase in importance. The sweet oil is also used in cosmetic perfumes, but only in small quantities.

Either oil may be used for the isolation of anethole, although the methods used may differ; for example, freezing has been a common technique with sweet fennel oil. Although synthetic anethole is available, some users still prefer to use an anethole of natural origin, although the oils of star anise and anise are more commonly used. Indeed, in some countries current food and drug laws have had the effect of favouring natural anethole, thereby arresting its decline and even bringing about a mild resurgence of its demand.

An oleoresin of fennel exists, but only very small quantities are produced and its uses are of a rather specialised nature. Its existence therefore does not appreciably affect the market for the oils and is unlikely to do so in future.

PRODUCTION AND EXPORTS

No export statistics are published for bitter fennel oil, but from the few import figures available and from trade opinion it would seem that West Germany is the dominant exporter, with considerable trade not only with neighbouring European countries but also with the USA and Japan. Total annual exports may be in the range of 5 to 10 tonnes per year. What is less certain is how great a proportion of this total is distilled from imported seed and how much is merely re-exported, but the evidence suggests that the greater proportion is locally produced. Chinese oil is regularly marketed in packs of two cans each of 15 kg capacity, and is destined mainly for the USA. Spanish oil is despatched to numerous destinations with no special bias in favour of any particular region. Chinese and Spanish annual production and exports are probably of the order of 1 to 5 tonnes each. French production is small and is mostly consumed locally, the seed being obtained from Eastern Europe and from India, although some seed is locally grown. In any case, France is also an importer. Hungary, India and other minor producers are not regular suppliers to the world market, although India, with her substantial local supplies of fennel seed, is probably in a position to enter the market on a larger scale. Chile was once reported as showing interest in producing this oil, but supplies have yet to appear

on the market. On the other hand, there have been reports that Egypt already has the capacity to market up to 2 tonnes a year, although the position is as yet not fully clear.

Spain accounts for maybe two-thirds of world exports of sweet fennel oil, with 9 to 10 tonnes per annum on average, most of the balance being attributable to France and Morocco, Italy's share being small. The average annual volume of world exports is in the range of 10 to 20 tonnes, a more precise estimate is not possible.

World production of both oils is almost certainly rather greater than world exports on account of consumption within the countries of origin, but the difference between the two totals is unlikely to be great. It is, however, believed that Italian production is significantly greater than Italian exports, owing to the demands of the Italian food industry.

MARKETS

The United States of America

Imports of bitter fennel oil into the USA were reported by the trade as coming from China, and those of the sweet oil from Spain and France, although it is possible that so-called French oils were redistilled Spanish oils. These reports, however, probably amount to less than the whole story and there is almost certainly some West German trade with the USA, at any rate in bitter fennel oil. One dealer estimated US demand for the oils of fennel as between 5 and 10 tonnes per annum, and this is probably realistic. As well as being widely used in the various applications mentioned in the introductory paragraphs (p. 38) sweet fennel oil is used in dental preparations and the bitter oil in the manufacture of certain sausage products. The oils are not used in pharmacy to the extent that they are in West Germany, but there are still several applications in cough remedies, mouthwashes and one or two other products.

West Germany

Spain is the major source of West German fennel oil imports, but, as already indicated, there is some local production of bitter fennel oil. Occasional consignments are imported from Eastern Europe. The size of the West German market is in the range of 3 to 5 tonnes per annum, and demand is either static or possibly increasing very slightly. Although the oils are used to some extent by the food and perfumery industries, the main thrust of demand seems to emanate from the pharmaceutical industry, and in this field fennel is also used in the form of extracts, tinctures and oleoresin. Furthermore, it is in West Germany that fennel oil has on occasions been used for flavouring cigarette tobacco.

Other markets

The United Kingdom market for the oils of fennel is smaller than the West German market. Between 1 and 2 tonnes per annum of sweet fennel oil are imported from Spain and maybe only one-quarter of that amount of bitter fennel oil. Demand does not appear to be biased towards any particular sector, although perfume companies use very little. The French market cannot easily be quantified but it is probably greater than the UK market, and it is served by Spanish and Moroccan oils as well as by some local production from imported seed. As already indicated, it is in France that the historical decline in demand for sweet fennel oil has been most pronounced, but some manufacturers of the 'Pernod' type of drink still favour sweet fennel oil. In fact it is this type of alcoholic drink which accounts for the greater part of the French demand for the oils of fennel, and it appears that it is the sweet oil that is in greatest demand. Dutch demand is very small and can be measured in kilograms per annum rather than tonnes; a little is locally distilled from imported seed. No indication was forthcoming of the range of uses, but there appears to be no special bias in favour of any one sector. Japanese demand is of the order of 2 tonnes per annum; during the 1960s there was some expansion of demand, but in recent years there has been a slight decline. West Germany is the

main supplier, from which it can be concluded that demand is chiefly for bitter fennel oil; the main users are the food and pharmaceutical industries.

Many other countries import fennel oil but only in quantities of a few kilograms, or in some instances hundreds of kilograms. An appreciable market is said to exist in Argentina, which is interesting in view of the tentative plans reported to have been drawn up for production in Chile.

Market structure

The oils of fennel are marketed through the normal network of dealers and export and import agents, and so far as is known there are no special features of the fennel oil trade that set it apart from other herbaceous oils.

PRICES

A price series is given in Table 8, Appendix A. Unfortunately it is only since 1974 that the statistical sources specifically distinguished the two oils, and it would appear that the only regularly published statistics relate to sweet fennel oil. It is worth noting that by the first quarter of 1974, when it was last quoted, the price of the unspecified oil had leapt from £1.49 per kg to £7.76 per kg. The effects of the 1973–74 boom will be very obvious from Table 8, and although there has been a decline from the peaks of that time, current prices are well above pre-boom levels. At the end of 1977 the following prices were ruling:

Sweet fennel oil (Spanish)	£11.20/kg spot (London);
Sweet fennel oil (Spanish) USP grade	£11.50/kg spot (New York);
Bitter fennel oil (Spanish)	£5.00–£8.00/kg f.o.b. (New York) according to quality.

Generally speaking, sweet fennel oil is rather higher-priced than bitter fennel oil. The range of bitter fennel oil prices reflects a greater degree of quality variation than is apparently experienced with the sweet oil, and this is in large measure due to the occasional practice of adulterating the natural oil with natural or synthetic anethole and one or two other additives. However, although some users are somewhat anxious about this, it is certainly not regarded as so serious and unacceptable a practice as the adulteration of many other essential oils. In fact, some members of the trade prefer in this instance to use the word 'modified' rather than 'adulterated'.

PROSPECTS

Because of the existence of several alternative sources of anethole, both natural and synthetic, the demand for the oils of fennel is rather more price-elastic than is the case with most other herbaceous oils. This is particularly true of sweet fennel oil, and at present price levels the future of this oil cannot be regarded as promising, although demand will not necessarily decline sharply. Bitter fennel oil, although also used as a source of anethole, may enjoy a rather more stable future in those applications where it is used in its own right, although the overall level of demand is not likely to increase to any great extent. The increasing availability of synthetic anethole and the probability of more regular supplies of the oils of anise and, in particular, star anise from South-east Asia, will keep demand for the fennel oils at a low level. As there is no prospect of supply problems in relation to either oil, it would be very difficult to make a case for encouraging the entry of new producers into this market.

Basil

INTRODUCTION

Broadly speaking there are two widely recognised basil oils of commerce, namely sweet basil oil and Réunion-type basil oil. However, there are other oils which do not fit neatly into either category, these tending to contain relatively large amounts of one or other of the chemicals methyl cinnamate and eugenol. Both of the well-known oils are distilled from varieties of the plant *Ocymum basilicum.* Sweet basil oil is produced mainly in Europe, while production of Réunion-type oil, which obviously was originally produced in quantity in the Indian Ocean island of Réunion, has in recent years been undertaken in the Comoro Islands.

Sweet basil oil is occasionally known as true or French basil oil and its principal constituents are cineole, d-linalol (about 40 per cent) and methyl chavicol (about 25 per cent). Its odour is regarded as of the very finest among basil oils, and this fact is reflected in the nature of the products in which it is used, which include French liqueurs of the 'Chartreuse' type, highest-grade perfumes and the more expensive types of culinary seasoning. The quantities produced, and used, are small in comparison with Réunion-type basil oil. The latter oil is cheaper, more plentiful and of greater importance in trade, although it should be said that on account of its lower strength more of it is required in any given application than is the case with sweet basil oil. It prossesses a comphoraceous, tarragon-like and sometimes aniseed-like odour, more generally 'spicy' than that of sweet basil oil. Its main constituents are d-α-pinene, cineole, d-camphor and methyl chavicol. Réunion-type oil is used in food flavouring but it has mostly been used in perfumery, particularly in men's cosmetics.

Sometimes – and in the case of some sources increasingly – there appear on the market basil oils which, like the sweet basil oil, contain methyl chavicol and linalol, but which in addition contain methyl cinnamate in appreciable quantities. Notable among sources of this type are Egypt and the Balkan states, although Indonesia has also been reported as supplying small consignments. Eugenol-type oils are commercially of least importance, but China has been known to export small quantities which are of interest primarily on account of their relatively high content of the phenols eugenol and thymol, although these could readily be obtained from other sources. The total world market for the oils of basil is around 10 to 12 tonnes per annum, and at the time of writing there was a strong unsatisfied demand.

PRODUCTION AND TRADE

Production of sweet basil oil takes place mainly in southern France, although very small quantities are produced in Spain, Morocco and one or two Eastern European countries, notably Hungary. Production of sweet basil also takes place in the USA, mainly in California, but this is chiefly for use in the dried state rather than for oil distillation. It must be remembered that some Eastern European oils, notably those emanating from Bulgaria and Yugoslavia, are midway in quality between the sweet

and Réunion-types and contain some methyl cinnamate, as already mentioned. World production of the true sweet basil oil is probably under 1 tonne per annum, and a very large proportion is consumed in France.

Comoran production of Réunion-type basil oil was until recently of the order of 3 to 5 tonnes per annum, but it would appear that the recent fundamental political changes there have occasioned a fall in production to below 1 tonne per annum, and it remains to be seen whether production will recover. Réunion's present production is probably considerably less than 1 tonne. South Africa and Egypt are rapidly becoming important suppliers, with annual production potentials already of 3 to 4 tonnes and 2 tonnes respectively, but their oils, particularly the Egyptian, are not wholly substitutable for the oils from traditional sources. In the case of the Egyptian oil there is, if anything, a greater resemblance to the Balkan oils than to the Réunion-type. Other producers include Madagascar – which, as would be expected, produces a true Réunion-type oil, although in small and intermittent quantities – China, Vietnam, Indonesia and Pakistan, the last three in descending order of importance and in each case not producing a true Réunion-type oil, but rather one of the intermediate types. The USSR is known to produce small quantities of eugenol-rich basil oil. For a short period, some years ago, Thailand exported small quantities of basil oil, but currently there is no known commercial production and it is uncertain whether production will be resuscitated in the near future. World production of Réunion-type and very closely-related oils has been of the order of 7 to 9 tonnes per annum, while the intermediate types, including those relatively rich in methyl cinnamate and eugenol, make up the remaining 2 to 3 tonnes.

MARKETS

The United States of America

The USA is probably the largest market for basil oil, estimated imports averaging 6 tonnes annually. As the Comoro Islands and Réunion, and to some extent Madagascar, are the favoured sources and the Egyptian and Eastern European oils are less favoured, it can safely be concluded, even allowing for the large difference in world production levels, that all but a tiny fraction of USA consumption is of the true Réunion-type basil oil rather than of the sweet or intermediate types. It would appear that such basil oil as has been produced over the years in Thailand has been sold mainly in the USA. The shortages so evident at the time of writing have given rise to one or two attempts to encourage other countries, such as China, Indonesia and Colombia, to promote basil oil production but the results cannot yet be determined.

In the USA basil oil is marketed mainly via dealers and is used in both perfumery and flavouring. The flavouring applications include confectionery, baked goods and meat products, but the perfumery industry is the major consumer, although the use of basil oil appears to be restricted to one or two, albeit popular, types of perfume. These uses do not appear to be subject to fashion swings and constitute a slowly but steadily growing market, and, provided the price levels brought about by the current shortages do not bring about a diminution in the quantities used, the market should remain secure. Most US users do not use more than a few hundred kilograms per annum and therefore the short-term price level is not very critical, but prolonged high prices do cause restlessness among users and a tendency to seek alternatives in the long-term.

Western Europe

The main European users of the oils of basil, in order of priority, are West Germany, France, the UK and the Netherlands. Total consumption by these countries is of the order of 4 to 5 tonnes per annum, of which the German share (estimated at 1 to 2 tonnes) is probably the greatest. As already indicated, the French preference is for the sweet basil oil, which is produced mainly in France, but which is also imported in small quantities from Spain, Morocco and those East European countries which offer a true sweet oil. French users do not on the whole favour either Egyptian or

Vietnamese oil. The uses of sweet basil oil have already been described and are mainly relevant to the French market. For less expensive perfumery products France imports small quantities of Réunion-type oil, mainly from those producing countries with close traditional links with France, namely the Comoros, Réunion and Madagascar. One agent was in the process of negotiating a major purchase from South Africa, but whether for consumption in France or for resale to other European countries is not known.

The UK, West Germany and the Netherlands buy basil oil from a wider range of sources than does France, including most of the Eastern European countries, Egypt (particularly in the case of West Germany) and South Africa. Regular supplies are also obtained from France, particularly in the case of the UK and largely of sweet basil oil although, as already remarked, France very possibly has an appreciable re-export trade in Réunion-type oil. Some dealers report that some consignments of oil are blends of the two types, and this is acceptable with several users; these blending operations appear to take place mainly in France. In all three countries under discussion there is some usage of basil oil in meat products, and here and there, in confectionery, but it is clear that medium-quality perfumery is the main outlet, with some emphasis on men's products.

The market for basil oil in Western Europe is secure and will remain so provided that prices are contained. The French tendency to move away from labour-intensive activities, such as herb production, may eventually give rise to an increase in demand for sweet basil oil from other sources, but ther has yet to be positive evidence of this coming about.

Other markets

The Japanese market for basil oil appears to be very small indeed. The little that is used is employed mainly in the production of ham and sausages, although it is far from clear whether sweet or Réunion-type oil is used. The Swiss and Belgian markets are equally small, although the emphasis there is much more on perfumery. No information was forthcoming on other markets, including the Comecon countries, but it is highly probably that usage outside the markets already discussed is extremely small.

In accordance with the familiar pattern, the dealer is the most important intermediary in the marketing of basil oil in Western Europe and Japan, and in many cases both export and import agents are also in evidence.

PRICES

The trend in price movements relating to basil oil for the past eleven years is shown in Table 9, Appendix A. The price premium commanded by French oils is clearly apparent. Very often large differences have been observed between London prices and New York prices, and this may reflect the difference between the size of the two markets and the related fact that shortages are generally more keenly felt in the USA. The following recent spot quotations illustrate the impact of the decline in the production and exports from Réunion and in particular the Comoros, and in the view of the authors these price levels are incompatible with the long-term stability of the market:

Balkan	£46/kg (French dealer);
Comoran	£50/kg (French dealer);
Madagascan	£49/kg (French dealer);
Unspecified	£37/kg (German dealer);
Unspecified	£26/kg (New York dealer);
Sweet	£49/kg (French dealer).

PROSPECTS

The prospect for the basil oil market would seem to be for slow, if steady, growth. Such fluctuations on the demand side as occur are likely to be attributable to movements in the general level of economic activity rather than to fashion changes although, at least in the perfumery field, it is precisely such luxury products as men's toiletries which are most hit during a recession and the concomitant squeeze on real incomes. On the supply side, there may be room for an additional producer of Réunion-type oil if Comoran production fails to recover. There is, however, no certainty that it will not recover, and in any case the trend in South African and Egyptian production in recent years has been strongly upwards. As already mentioned, opportunities may arise for production of sweet basil oil if France's production declines, but it must be stressed that there are very few instances of successful production of the sweet type of basil oil in the tropics or sub-tropics. It is unlikely that important new uses will appear on the scene, and the primary emphasis will need to be placed on ensuring that prices are kept to a level acceptable to both dealers and producers, which should certainly be below their present level.

Oleoresin of basil is used in some flavouring applications, generally in meat flavouring and predominantly in the USA which is its sole producer. However, the quantities of oleoresin produced and used are extremely small, even in comparison with those of basil oil.

Parsley

INTRODUCTION

Although three distinct essential oils have been distilled from the parsley plant, only two are known commercially, namely parsley seed oil and parsley herb oil. Of the two, the seed oil is the more widely known and used.

Parsley seed oil is steam-distilled from the seeds of the parsley herb *Petroselinum sativum*, a herb which is generally regarded as native to the Mediterranean area, but which grows widely elsewhere and is even more widely cultivated. Distillation takes place mainly in France and, to a lesser extent, Hungary, the Netherlands and the UK, while production in small quantities is undertaken from time to time in West Germany, Poland, Italy and India. 'Superannuated' seed, that is to say, seed which no longer has germinating power, is the best material for distillation, and therefore there can be no question of competition with parsley destined for the vegetable-seed trade. The supply of 'superannuated' seed is limited, but not sufficiently so to present difficulties in relation to demand for the oil.

Parsley herb oil is distilled from the upper parts of the same plant and provides a better reproduction of the aroma of the herb so widely used as a garnish than does the seed oil. Nonetheless, on account of the low yield of oil, the price is high and in consequence this oil is used on a much smaller scale than is the seed oil.

The oils of parsley are used mainly in the flavour industry, with much smaller quantities finding applications in perfumery. Among the specific uses are cured and canned meats, condiments, aroma compounds for use in pastry, soups and, on the perfumery side, soaps and men's-line fragrances. The taste of the seed oil is rather bitter on account of its apiole (a phenol ether) content, and in consequence it is generally used in combination rather than on its own. The two oils are sometimes blended together.

Both parsley herb and seed oleoresins exist and are extracted by a US and a UK flavour house, but only in very small quantities. They are used in flavour applications very similar to those of the two oils, and in consequence there is a definite element of competition between the oils and the oleoresins. Other parsley products include certain infusions and decoctions from the roots of the plant, but these are mainly used in pharmacology and are unrelated to the essential oils.

PRODUCTION AND EXPORTS

Production of the parsley oils is very difficult to estimate with accuracy, owing to a general lack of statistics. Taking into account the opinions of a large number of dealers and processors – and it must be said that these opinions varied widely – it would appear that world production and consumption of parsley seed oil does not exceed 10 tonnes and may be only 5 tonnes per annum, while annual production of parsley herb oil is of the order of a few hundred kilograms. Probably 60 to 70 per

cent of seed oil production takes place in France, although the seed is generally imported from Hungary and othern Eastern European countries. It also appears that a proportion of the seed oil distilled in Eastern Europe is sold via France. Little information is available on the other producers, although it is clear that Dutch production is mainly taken within the national borders by one of the major processing houses. Production of the herb oil is probably evenly divided between France and Eastern Europe, but information on this oil is extremely sparse.

Production of the parsley oils in other countries does not appear to take place on a regular basis and often it is undertaken only as a result of short-lived interest and pressure of demand. A Swiss dealer suggested that there might be production in Spain since his purchases were made from a Spanish dealer, but it is more likely that the latter was in fact re-exporting French oil.

MARKETS

The United States of America

From information supplied by the US trade it would appear that, in certain respects, there are rather more links in the parsley oil marketing chain than for many other oils of similar minor importance. This has come about mainly because of the comparative lack of direct trading links between the USA and Eastern Europe. Although one dealer reported direct purchases from Comecon countries, others implied that oil of Eastern European origin is more likely to be purchased from Belgium or West Germany. The Comecon countries are not the USA's sole suppliers, however, and very substantial purchases are also made from France. Annual consumption in the USA appears to be of the order of 2 to 3 tonnes, which means that it is almost certainly the largest consumer. Most of the oil is used by one or two large flavour houses, and the remainder by a larger number of perfume compounders.

It was reported by one US dealer that an 'artificial' parsley oil was on the market, while another referred to the existence of 'adulterated' oils. It is unlikely that there is, or will be, much threat to parsley oils from synthetic alternatives, since they are used in such very small quantities, but recent temporary although severe shortages may have induced some dealers to 'stretch' their supplies with artifically-produced isolates. If natural parsley oil supplies are maintained at normal levels, there is no reason to expect regular sales of oils that have been in any way modified.

Other markets

As has already been indicated, most of the Netherlands' supplies of parsley oils are locally distilled from imported seed. In 1974–75 for example, although only a few kilograms of either oil were imported, one major processing company claimed to have used more than 1 tonne per annum: it is clear that the bulk of this was seed oil distilled by another large Dutch company. It would thus be reasonable to conclude that the Netherlands is the second largest consumer. The main outlet for the oils appears to be as a flavouring agent in a range of savoury products, including processed meats, sauces and condiments.

The UK's requirements are, if anything, rather lower than those of the Netherlands, and around 75 per cent of these requirements are satisfied by local production, the balance being imported from France. Demand in the UK may be in the region of 750 kg to 1 tonne. West Germany also consumes similar quantities, although the bulk of its requirements are imported, mainly from France and Eastern Europe. France consumes modest quantities, all locally distilled. Few other markets, if any, are of any consequence, and those that exist are probably served mainly by France.

Market structure

Although the basic market structure discussed in the Introduction (p. 11) of this report can be said to apply to the parsley oils, the observations just made (on this page) in the section dealing with the US market should also be noted. In many cases

trade between Eastern Europe and markets outside Western Europe involves the use of a Western European intermediary, usually a dealer. This qualification apart, there are no special features to be noted in the marketing of these oils.

PRICES

Price information on the oils of parsley is scarce, and the information given in Table 10, Appendix A mainly applies to English-distilled parsley seed oil. As can be seen, these prices have been fairly stable until quite recently. The high price ruling at the beginning of 1977 probably reflected the brief yet acute shortage already referred to in the section on the US market (p. 46), while the permanent rise which occurred in 1974 is explained by the world-wide commodity boom. It was a feature of that boom that, while the prices of most large-volume commodities thereafter fell back substantially, the prices of some smaller, less price-elastic products found a new level and maintained it. The most recent spot price quotations for parsley seed oil, however, suggest that the price is once again rising to new peaks, that is to say £55 to £65 per kg, but the reasons for this were not clear at the time of writing. No recent quotations for parsley herb oil are available but the order of magnitude has been £170 to £450 per kg over an eighteen-month period. It is more usual for quotations to be given for smaller quantities, say 1 oz (28.35 g), 50 grams or 100 grams, since the quantities concerned are so small.

PROSPECTS

It is unlikely that there will ever be good prospects for a new entrant into the market for the oils of parsley, even for the seed oil. Unless the recent brief shortages and current high prices indicate a contraction of supplies from more than one of the main sources, there is no reason to believe that demand will not continue to be met. In any case a short-fall for one source would probably be counterbalanced by an increase in production from another established source, at least beyond the short term. Demand has not been rising to any degree during the past 10 to 15 years, and it is fairly likely that any increase in demand for the parsley flavour which might occur would be met by an expansion in oleoresin production. There is, of course, no certainty that any such demand in increase will come about and in fact at present there are no signs of it.

Other oils

INTRODUCTION

This section contains information on five other herbaceous oils sometimes traded on the world market. None of these oils is of more than very minor importance and it is most unlikely that they could ever be of interest to prospective producers in the tropics or sub-tropics. They are included only for the sake of completeness. Documentation and trade information on these oils are extremely scarce.

BAY (LAUREL LEAF)

There are two oils traded under the name of bay oil or bay leaf oil. One is produced in the Caribbean island of Dominica, and also occasionally in Puerto Rico and Montserrat from the leaves of the tree *Pinenta racemosa*, which is best known for the bay rum which can be produced from it. The other bay oil is also known as laurel leaf oil and is distilled from the leaves of the culinary bay, that is to say the *Laurus nobilis* which grows widely in Mediterranean Europe, Asia Minor and North Africa. The information which follows relates only to the latter oil, as the former does not, strictly speaking, qualify for the description of herbaceous oil since the leaves of the West Indian bay tree are not used in culinary applications.

Oil of *L. nobilis* is produced mainly in Yugoslavia, Albania and Turkey; Morocco is also reputed to produce the oil at regular intervals. Other, occasional producers include Egypt and Lebanon, and a UK firm produces small quantities. World production is of the order of 1 to 2 tonnes, and the main users appear to be West Germany and the Netherlands, although the oil was also known and intermittently used in the USA and the UK. West Germany and the Netherlands between them use around 1 tonne annually, mainly in the flavouring and preservation of fish and canned meats. In France it is used in pork products and convenience foods, and also to a small extent in perfumery. An American user has indicated that manufacturers of pizza-type preparations use this oil in small quantities. Usage in the UK appears to be restricted to flavouring fish and canned meats. It is also used in certain soups, sauces and pickling preparations. Demand for this oil is not increasing and is unlikely to do so in future, and supplies appear to be well maintained. Little is known about quality grading, but it seems clear that there is more than one grade, since more than one price was found to be quoted at any one time. This oil is fairly expensive and prices have varied from £15/kg to £30/kg in recent years.

An oleoresin is produced from the leaves of *L. nobilis* in small quantities and is used alongside the oil in meat preparations.

TARRAGON

Tarragon oil, or estragon oil as it is sometimes known, is distilled from the herb *Artemisa dracunculus*, which is native to Europe and North Africa, and is quite

widely used by housewives. The oil is used both in high-class perfumery, particularly in France, and in a range of food applications which include soups, sauces and, in particular, pickling compounds. World production is of the order of 1 to 3 tonnes and is concentrated mainly in southern France, although other known producers include Italy, Spain, Morocco, Hungary and the USA. The quality and characteristics of this oil vary from source to source; thus although the French oil is of very high quality, the West German industry, for example, seems to prefer the Italian type, while US users, who regard it as a gourmet item, tend to favour the home-produced oil, although there is seldom enough of the latter to satisfy demand. Some users maintain that more could be sold if more were available and the price were lower, but even if this is true it is very unlikely that there could be opportunities for new producers. The price varies between £50/kg and £70/kg, making tarragon oil one of the most expensive essential oils, but in spite of such high price levels the present level of demand seems likely to be maintained, as there is no close substitute for the oil.

A tarragon oleoresin is manufactured in small quantities, while a specialised tincture is used in wines and certain types of liqueur. It is quite possible that the existance of the oleoresin may have held back demand for the oil slightly, but this is of little consequence as so little is used.

MISCELLANEOUS

Chervil oil is distilled in extremely small quantities, in the Netherlands and in India, from the herb *Anthriscus cerefolium.* World production is only of the order of 100 kg. It is used in food flavouring, almost certainly in soups.

Savory oil is distilled from the herb *Satureia montana*, which grows mainly in Southern and Eastern Europe and the midwestern USA. The main producers are a single firm in the Netherlands, and the USSR and maybe one or two other Eastern European countries. World production is of the order of 200 to 400 kg, which ranks it among the very minor oils. It is used in the flavouring of sausages, stuffings, herbal mixtures, baked goods and condiments; it also has very occasional perfumery applications. Its main constituent is carvacrol, although significant quantities of thymol are sometimes present, and there is consequently some relationship between this oil and the oils of origanum and thyme. An oleoresin is also produced and its uses are similar to those of the oil, while a tincture is prepared for special applications such as liqueurs. Demand for the oil is static.

Garlic oil is obtained from the well-known herb *Allium sativum.* The essential oil is produced in Italy, the UK and possibly several other countries including France. In the case of the UK, the herb has to be imported from Italy, France and Spain. Garlic oil is a very powerful material which is used in small quantities in the canning of certain foods, and in trace amounts in certain perfumes and pharmaceuticals. Only a few hundred kilograms are produced annually, and the very low yield, combined with the precise processing techniques needed, ensures that this oil commands a high price, over £100/kg in the UK at the time of writing. Important though it is in its specialised uses, it cannot be regarded as an oil of potential interest to countries which do not at present produce it.

APPENDIX A

Tables (Price series)

1 Rosemary oil
2 Oils of dill seed and dill weed
3 Oils of sweet and wild marjoram
4 Origanum oil
5 Thyme oil
6 Sage oil
7 Oils of celery herb and celery seed
8 Fennel oil
9 Basil oil
10 Parsley oil

Table 1

Rosemary oil: average annual prices 1967–77

£ per kg

	Spanish (c.i.f UK)	Tunisian (c.i.f UK)	Moroccan (c.i.f UK)
1967	1.24	1.61	. . .
1968	1.23	1.59	. . .
1969	1.21	1.54	. . .
1970	1.21	1.54	. . .
1971	1.21	1.54	. . .
1972	1.21	1.54	. . .
1973	1.65	1.54	. . .
1974	6.56	4.20	7.98
1975	5.95	–	5.86
1976	5.12	–	5.58
1977	6.05(a)	5.75(b)	5.30

Source:
International Perfumer/ Cosmetic World News

Footnotes:
(a) First quarter only
(b) Second quarter only
– Not quoted
. . . Information not available or insufficiently reliable

Table 2

Oils of dill seed and dill weed: average annual prices 1967–77

£ per kg

	Indian dill seed oil (c.i.f UK)	US dill weed oil, standard quality (f.o.b New York)	US dill weed oil 'extra' quality (fob New York)
1967	3.58	3.39	3.63
1968	3.58	6.94	7.24
1969	...	6.89	7.07
1970	...	4.87	5.63
1971	...	3.41	4.53
1972	...	3.38	4.41
1973	...	3.70	4.50
1974	4.85	–	–
1975	4.85	10.64	12.19
1976	4.85	–	10.95
1977	4.85(a)	14.77(b)	16.84(b)

Sources:
International Perfumer/ Cosmetic World News;
Oil Paint and Drug Reporter/ Chemical Marketing Reporter

Footnotes:
(a) First quarter only
(b) First two quarters only
– Not quoted
... Not available

Table 3

Oils of marjoram: average annual prices 1967–77

£ per kg

	Sweet marjoram oil (origin unspecified, c.i.f UK)	Wild marjoram oil (Spanish, c.i.f UK)
1967	...	1.35
1968	...	1.66
1969	...	2.20
1970	...	2.20
1971	...	2.20
1972	...	2.20
1973	...	2.82
1974	37.00	7.74
1975	37.00	8.84
1976	37.00	8.95
1977	40.00(a)	9.30(b)

Source:
International Perfumer/ Cosmetic World News

Footnotes:
(a) First quarter only
(b) First two quarters only
... Information not available or insufficiently reliable

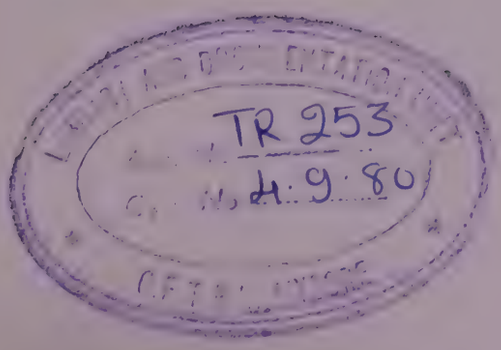


Table 4

Origanum oil: average annual prices 1967–77

£ per kg

	Spanish 70% (c.i.f UK)	Lebanese 70% (c.i.f UK)
1967	3.09	. . .
1968	3.09	. . .
1969	3.09	. . .
1970	3.09	. . .
1971	3.09	. . .
1972	3.09	. . .
1973	3.09	. . .
1974	8.27	8.50
1975	10.08	8.50
1976	9.90	8.50
1977	14.75(a)	8.50(b)

Source:
International Perfumer/ Cosmetic World News

Footnotes:
(a) First two quarters only
(b) First quarter only
. . . Information not available or insufficiently reliable

Table 5

Thyme oil: average annual prices 1967–77

£ per kg

	Spanish red thyme oil (44–55%) (c.i.f UK)	Spanish white thyme oil (thymol content unspecified) (c.i.f UK)
1967	3.14	2.81
1968	3.14	2.81
1969	3.14	2.81
1970	3.14	2.81
1971	3.14	2.81
1972	3.14	2.81
1973	3.66	2.81
1974	8.68	4.01
1975	10.12	4.57
1976	8.72	5.68
1977	10.60(a)	5.70(a)

Source:
International Perfumer/ Cosmetic World News

Footnote:
(a) First two quarters only

Table 6

Sage oil: average annual prices 1967–77

£ per kg

	Spanish (c.i.f UK)	Dalmation (c.i.f UK)
1967	2.31	4.08
1968	2.23	3.70
1969	2.09	3.03
1970	2.09	3.03
1971	2.09	3.03
1972	2.09	3.03
1973	2.09	3.03
1974	7.82	6.03
1975	9.66	5.00
1976	10.39	5.00
1977	13.95(a)	7.35(a)

Source:
International Perfumer/ Cosmetic World News

Footnote:
(a) First two quarters only

Table 7

Oils of celery herb and celery seed: average annual prices 1967–77

£ per kg

	Celery herb oil (unspecified origin) (c.i.f UK)	English celery seed oil (c.i.f UK)	French celery seed oil (c.i.f UK)	Indian celery seed oil (c.i.f UK)
1967	13.78	...	...	11.32
1968	13.78	...	...	14.90
1969	13.78	...	...	14.90
1970	13.78	...	...	–
1971	13.78	...	...	19.00
1972	13.78	...	...	19.00
1973	13.78	...	...	18.00
1974	–	38.00	80.00	18.00
1975	–	38.00	61.80	–
1976	–	38.00	34.50	–
1977	–	45.00(a)	26.25(a)	–

Sources:
International Perfumer/ Cosmetic World News;
Chemist and Druggist (Indian oil only)

Footnotes:
(a) First two quarters only
– Not quoted
... Information not available or insufficiently reliable

Table 8

Fennel oil: average annual prices 1967–77

£ per kg

	Fennel oil, type unspecified before 1974, sweet fennel oil thereafter (c.i.f UK) – see text
1967	1.32
1968	1.38
1969	1.49
1970	1.49
1971	1.49
1972	1.49
1973	1.49
1974	14.59
1975	13.90
1976	13.90
1977	11.00(a)

Source:
International Perfumer/ Cosmetic World News

Footnote:
(a) First two quarters only

Table 9

Basil oil: average annual prices 1967–77

£ per kg

	Comoran (c.i.f UK)	Chinese (c.i.f UK)	French (c.i.f UK)
1967	–	11.02	88.07
1968	11.57	11.02	88.07
1969	11.57	11.02	88.07
1970	11.57	11.02	88.07
1971	11.57	11.02	88.07
1972	11.57	11.02	88.07
1973	11.57	11.02	88.07
1974	27.33	11.00(a)	61.50
1975	29.25	–	36.00
1976	29.92	–	37.33
1977	40.50(b)	–	51.00(b)

Source:
International Perfumer/ Cosmetic World News

Footnotes:
(a) First quarter only
(b) First two quarters only
– Not quoted

Table 10

Parsley oil (a): average annual prices 1967–77

£ per kg

	English Distilled (see footnote (a))
1967	13.23
1968	15.23
1969	18.74
1970	18.74
1971	18.74
1972	18.74
1973	18.74
1974	27.43
1975	27.00
1976	27.67
1977	33.00(b)

Source:
International Perfumer/ Cosmetic World News

Footnotes:
(a) The type of oil was unspecified prior to mid-1968, but was believed to be seed oil. Similarly it is not known with certainty whether quotations prior to 1974 were for English-distilled oil but this is probably the case
(b) First two quarters only

APPENDIX B

Tariffs

According to the latest available information at the time of publication of this report, import duties on herbaceous essential oils were charged as follows:

EEC : 3.2 per cent on all oils, unless special agreements have been reached with the exporting country or countries concerned, in which case this duty may be waived.

Japan :

	General rate	GATT rate	Preferential rate
Fennel oil	Free	—	—
Rosemary oil	Free	—	—
Thyme oil	Free	—	—
Other oils	(a)	10% (b)	Free

USA : The oils of rosemary, thyme and origanum enter the USA free of duty, regardless of source. Other oils are subject to a basic import duty of 3 per cent *ad valorem*, but countries to which the 'Generalised System of Preferences' (GSP) applies can obtain exemption from this duty; virtually all developing countries would come into this category.

Footnotes:
(a) Not fixed; subject to revision
(b) Maximum: reduced rates often apply

APPENDIX C

List of trading and processing firms handling herbaceous essentials oils

The following list is not intended to be exhaustive. Inclusion of the name of a firm in the list does not imply any knowledge of the financial standing of the firm on the part of the Tropical Products Institute.

UNITED KINGDOM

Bush Boake Allen Ltd, (processors and compound manufacturers)
Blackhorse Lane
London E17 5QP

R C Treatt & Co Ltd, (dealers and processors)
Northern Way
Bury St Edmunds
Suffolk

Fuerst Day Lawson Ltd (dealers)
1 Leadenhall Street
London EC3V 1JH

A E Wells & Co Ltd (agents and dealers)
500 Old Kent Road
London SE1 5AH

Blyth Greene Jourdain Ltd (dealers)
Plantation House
Mincing Lane
London EC3M 3EE

Zimmermann Hobbs Ltd (processors and dealers)
Dawson Road
Bletchley
Milton Keynes
Bucks MK1 1JR

International Flavours and Fragrances Ltd (processors and compound manufacturers)
Crown Road
Southbury
Enfield
Middlesex

H E Daniel Ltd (dealers, processors, compound manufacturers)
Longfield Road
Tunbridge Wells
Kent

Dragoco (GB) Ltd (processors and dealers)
Lady Lane Industrial Estate
Hadleigh
Ipswich
Suffolk IP7 6AX

Proprietary Perfumes Ltd (processors and compound manufacturers)
International Perfumery Centre
Ashford
Kent

Ungerer & Co Ltd (compound manufacturers)
Flint Road
Letchworth
Herts SG6 1HJ

FRANCE

Société les Fils et Petits-Fils de Maurice Duclos (agent-brokers)
8 Place Vendôme
Paris 1

Syndicat des Importateurs Exportateurs de Matières Premières Aromatiques (St Empa) (trade association)
2 rue de Penthièvre
Paris-8

Prodarom (trade association)
7 rue Gazan
Grasse

Schmoller et Bompard (processors and compound manufacturers)
Quartier de la Croix
06-Grasse

Cavallier Frères (processors and compound manufacturers)
BP 54
06332-Grasse

V Mane Fils SA (processors and compound manufacturers)
06620 Bar-sur-Loup
Grasse

Pierre Chauvet SA (processors and compound manufacturers)
83770-Seillans

Société P Robertet et Cie (processors and compound manufacturers)
Av. Sidi-Brahim
06-Grasse

H Reynaud et Fils (processors and compound manufacturers)
26570 Montbrun-les-Bains

SWITZERLAND

Sugro Ag (dealers)
Sevogelstrasse 21

Firmenich SA (processors and compound manufacturers)
1 route de l'Aire
CH-1211 Geneva 8

FEDERAL REPUBLIC OF GERMANY

Cornehls und Bosse (broker)
Bei Den Muhren 91
2000 Hamburg 11

Dragoco GmbH (flavour house)
Dragoco Strasse
3450 Holzminden

Herman Dullberg (flavour house)
Alsterdorfer Str 19
2000 Hamburg 60

Elida-Gibbs (manufacturer)
Hamburger Strasse 23
2 Hamburg 76

Frey & Lau (flavour house)
Behringstr 116
2000 Hamburg 50

Haarman & Reimer GmbH (flavour house)
3450 Holzminden 1
Postfach 138

Paul Kaders (agent, dealer)
Schauenburgerstr 21
2000 Hamburg 1

C Melchers & Co (agent, dealer)
Steindamm 48a
28 Bremen 77

Emil Thomsen GmbH (dealer)
Bellevue 7
2000 Hamburg 60

THE NETHERLANDS

Chemische fabriek Flebo b.v. (flavour house)
PO Box 24, Hoogezand

IFF (Nederland) b.v. (flavour house)
Zevenheuvelenweg 60
Tilburg

Maschmeijer Aromatics n.v. (flavour house)
Omval 81
Amsterdam 0

Mirandolle, Voute and Co b.v. (agent, dealer)
Westermarkt 2
Amsterdam 1002

Naarden International n.v. (flavour house)
PO Box 2
Naarden-Bussum

Polak's Frutal Works (manufacturer)
Nijverheidsweg Zuid 7

A Valenkamp & Co (broker)
152 Prius Hendrikkade
Amsterdam

JAPAN

Japan Flavor and Fragrance Manufacturers Association (trade association)
3F Nomura Bldg
3–2 Kodenma-cho
Nihonbashi, Chuo-ku
Tokyo

International Aromatics Traders Association (trade association)
c/o Ikeda Bussan Kaisha Ltd
New Tokyo Bldg, No 2 3-chome
Marunouchi, Chiyoda-ku
Tokyo

Felton Japan Co Ltd (flavour house)
Nishiyachiyo Bldg
23-26 Edobori, 1-chome
Nishi-ku, Osaka

Firmenich KK (flavour house)
Chiyoda-Daichi Bldg
50 Daiku-cho, Kita-ku
Osaka

IFF (flavour house)
5th Floor, Green Fantasia Bldg
Jingumae 1-11-11 Shibuya-ku
Tokyo

T Hasegawa Co Ltd (flavour house)
9 Hon-cho 4-chome
Nihonbashi
Chuo-ku
Tokyo

Mitsui Bussan Kaisha Ltd (trading house)
2–9 Nishishinbashi 1-chome
Minato-ku
Tokyo

Morimura Bros Inc (agent)
Daida Seimei Bldg (14th Floor)
Esaka-cho, Suita
Osaka

Takasago Perfumery Co Ltd (flavour house)
36–31 5-chome
Kamate Ohta-ku
Tokyo

THE UNITED STATES OF AMERICA

Essential Oil Association of USA Inc (trade association)
60 East 42nd Street
New York
NY 10017

Biddle Sawyer Corp (dealer)
2 Penn Plaza
New York
NY 10001

Bush Boake Allen Inc (flavour house)
475 Walnut Street
Norwood
NJ 07648

L A Champon & Co Inc (broker/agent)
70 Hudson Street
Hoboken
NJ 07030

Felton International Inc (flavour house)
599 Johnson Avenue
Brooklyn
NY 11237

Firmenich Incorporated (flavour house)
P O Box 5880
Princeton
NJ 08540

Fritzsche Dodge & Olcott Inc (flavour house)
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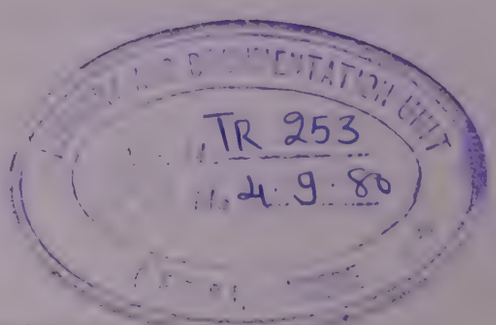
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Printed in England for Her Majesty's Stationery Office by Hobbs the Printers of Southampton
(2359) Dd0574711 K28 5/79 G3313

Tropical Products Institute

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The market for culinary herbs

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Ministry of Overseas Development

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Greenhalgh, P. (1979) The market for culinary herbs. *Rep. Trop. Prod. Inst.,* G121, x + 171 pp.

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Tropical Products Institute
ISBN: 0 85954 0979

Summaries

SUMMARY

The market for culinary herbs

The principal objectives of this report are to assess the present and longer term market prospects for the major culinary herbs, and to provide existing and potential suppliers of herbs with information on different aspects of marketing, including quality requirements, tariff levels, trade and distribution structure, usage levels in major markets and packaging and storage. The study is divided into two parts. Part I discusses some general aspects of the herb market, whilst Part II deals with specific aspects of fourteen of the major culinary herbs entering international trade.

The general conclusions of the report are as follows:

1 Most culinary herbs are indigenous to temperate and sub-tropical zones rather than the tropics, but there is scope for potential producers of culinary herbs and developing countries could become important suppliers of some herbs.

2 The demand for herbs is growing at around 10 per cent per annum, a much faster rate of growth than for most spices.

3 Shortages have developed from time to time for most of the herbs discussed in this report. The herbs for which demand is growing quickly and for which supply shortages are more frequent include basil, dill, marjoram, oregano, parsley, spearmint and tarragon.

4 Whilst demand is growing in each sector of the market, namely the household, industrial and food service sectors, it is in the last two that the greatest increase in demand is evident, reflecting the increasing popularity of convenience foods and the growing number of people eating away from home.

5 During the 1970s the price of herbs has been rising and all trade sources expect this general trend to continue, along with the continuing wide fluctuations of prices around the trend as a result of changes in production levels.

6 A growing proportion of the herb market is satisfied from cultivated production rather than herbs collected from the wild. In the short term, supply difficulties are expected to intensify as herb production in the traditional growing areas of Europe becomes increasingly uneconomic using existing techniques, because of land and labour cost increases. But in the longer term, sustained price rises could lead to more capital-intensive methods of production in consuming countries, and even if unit costs remained higher than those in developing countries, this may be counterbalanced by higher quality and savings on freight rates. The low value/high bulk ratio for most herbs makes freight charges an important consideration.

7 The major herb-consuming countries are becoming more 'quality-conscious' and quality requirements are likely to become more stringent, particularly with respect to cleanliness and the use of herbicides, fungicides etc.

8 In spite of the observation made in (5) there is certainly scope for new producers of culinary herbs, but several difficulties exist. In particular, herbs do not always transplant well and slight differences in climate and soil can make critical differences to flavour and odour, and therefore it may take a few years to produce suitable products. Moreover, the harvesting and drying of herbs to a satisfactory standard requires considerable skill and knowledge. Since the price of a particular herb can fluctuate widely from year to year, it is recommended that a new producer should attempt to diversify his output from the beginning, producing initially only small quantities of each herb.

9 In order to gain access to the market it is recommended that a new producer should work through established traders rather than selling directly to the major consumers. Established traders are able to facilitate transactions and convey to the producer the precise requirements of the market with respect to price, quality, quantities, packaging and so on.

10 Unless a producer can ensure excellent and consistent quality it is unlikely that he will be able to market herbs that have been processed beyond the initial drying stage, since for several reasons major users prefer to receive their herbs in the unground form.

11 Although processed herbs incur a higher rate of import duty than do unprocessed herbs, tariff barriers do not, and probably will not, constitute a major obstacle to trade (Appendix C refers). There are far more serious obstacles than tariff barriers, particularly quality specifications.

12 Several major herb dealers and processors have recognised the need to encourage herb production and ensure adequate supplies, and have thus helped to promote production in developing countries. This can take a variety of forms, such as the provision of technical advice on growing and processing, as well as direct investment.

13 Whilst in industrial usage there was a movement away from herbs towards the corresponding oleoresins in the late 1960s and early 1970s, herb oleoresins, with the exception of celery seed and sage, are not widely used. Many argue that herb oleoresins fail to reproduce the natural flavour, and they do not yet present significant competition for dried herbs.

14 The following herbs are dealt with in this report:

Basil, of which there are two main commercial varieties, namely, sweet or common basil (*Ocimum basilium*) and the less popular dwarf or bush basil (*O. minimum*). All production entering trade is cultivated and is undertaken throughout the world, but particularly in Europe, the USA and Egypt. The USA dominates international trade, importing 412 tonnes in 1976, but France, Italy and West Germany are also sizable markets. Prospects for basil are dependent on the continued expansion of Italian and Mexican styles of cooking, in which it is mainly used. Demand should continue to increase by at least 10 per cent per annum and a new producer supplying a good quality basil at around $1.00 per Kg fob should have little difficulty finding a market.

Bay (laurel) leaves are one of the most important traded herbs and are obtained from an evergreen tree (*Laurus nobilis*). Commercial production is centred on the Mediterranean with Turkey being the main exporter, supplying an average of 1 250 tonnes per annum. Smaller exporters include Greece, Yugoslavia, Morocco and France. Bay leaves are widely consumed throughout Europe and North America. Quality differences lead to wide price differentials with current fob prices varying between $1.00 and $1.50 per Kg. Consumption of bay leaves will continue to grow, but any new producer may have difficulty competing with existing Turkish production.

Celery (*Apium graveolens*) is available as celery seed, celery flakes and as a vegetable, and celery seed oleoresin is also widely employed. Celery is grown world-wide and a large proportion of the demand for celery flavour is satisfied by local production. India dominates world exports of celery seed supplying an average of about 2 500 tonnes per annum to over 50 countries, the most

important of which is the USA. Future prospects for celery seed are dependent upon trends in Indian production.

Chervil (*Anthruscus cerefolium*) is a minor but expensive culinary herb and France is the dominant producer, consumer and exporter. West Germany, the Netherlands and the USA consume small quantities, usually less than 20 tonnes per annum, and most traders contacted appeared satisfied with existing suppliers.

Dill is available commercially in the form of dill leaves (dill weed) and dill seeds. It is mainly dill seeds, obtained from *Anethum sowa* that enter international trade. India dominates dill seed exports, annually supplying around 900 tonnes, of which the USA imports around 70 per cent. Consumption of dill weed is smaller, but growing more quickly than dill seed. The USA is the major producer and market for dill weed, whilst West Germany is another major market. Whilst the future fob price of dill seed is likely to remain about $0.50 per Kg, the price of dill leaves will be considerably higher. Future consumption will be very much dependent on the expected growth of the pickling industry, which is the main consumer of dill products. Production of dill weed is a more attractive proposition than dill seed.

Sweet **marjoram** (*Marjorana hortensis*) is an important kitchen herb having a wide range of uses and is cultivated throughout Europe and the Mediterranean as well as North and South America. France and Egypt are major exporters but with few statistics available, combined with the fact that oregano is sometimes sold as marjoram (and vice versa) quantification is difficult. The USA consumes about 300 – 400 tonnes per annum, but France and West Germany are larger markets consuming over 500 tonnes. The usual fob price for marjoram is around $1.30 per Kg, but frequent supply shortages lead to wide price variations. The market prospects for this herb are good and new producers would be welcome.

Peppermint leaves (*Mentha piperita*) are widely used for medicinal purposes and in the preparation of mint tea, whilst **spearmint** leaves (*M. spicata*) are most used for culinary purposes, especially mint sauces. Many countries produce mint and it is a popular flavour throughout the world. Demand is growing, and a new producer of mint leaves, particularly spearmint, supplying a good quality product at about $1.00 per Kg fob would have little difficulty in selling his production.

The culinary world recognises two types of **oregano,** the European type (*Origanum vulgare*) of which Greece is the major exporter, and the Mexican type (*Lippia graveolens*) produced and exported mainly by Mexico. They are mainly used in pizzas and Mexican-style cooking. The USA dominates consumption, often importing over 2 000 tonnes from Mexico and Greece, whilst several European countries are also important markets. Prices have fluctuated widely, but the fob unit value of Greek oregano has been consistently almost double that of the Mexican variety, except in 1974 when both appeared to be in short supply and prices rose above the $2.00 per Kg level. Oregano consumption is probably growing faster than that of any other herb and hence production can be recommended to new producers.

Parsley (*Petroselinum crispum*) is a well known and widely used herb because of its diverse uses and widespread cultivation. Most parsley is used in the fresh state in the country of production, but an increasing proportion is now dehydrated for use. Only a very small proportion of production is traded internationally, but the market for dehydrated parsley should continue to expand and there is certainly room for a new producer, provided he can meet the high quality requirements of this market and sell his product at $1.25 per Kg cif or less.

Rosemary (*Rosmarinus officinalis*) grows wild and profusely throughout the Mediterranean area, with several countries exporting their production. The major markets are the USA and Europe. Because of the widely available supplies, rosemary is one of the least expensive herbs and its production cannot be recommended to a new producer.

There are many species of **sage** used commercially, but the one most commonly found in commerce is *Salvia officinalis,* produced mainly in Yugoslavia and Albania. Many other countries also undertake some sage production. Consump-

tion is widespread, with the USA being by far the major consumer, followed probably by the UK, Italy, Canada, France and Japan. Prices vary according to quality but the US fob value of Yugoslav sage is about $1.50 per Kg. The prospects for sage appear to be very good, but the extent to which a new producer can break into the market is very much dependent on his ability to provide a close substitute, in aroma and flavour, to existing Dalmatian supplies.

Several species of **savory** are produced but only small quantities are traded internationally, and in no country is savory an important item in the herb trade. France and Yugoslavia appear to be the important exporters whilst France, West Germany and the USA are the major markets. Prices vary widely but the fob unit value of US imports is about $0.95 per Kg. The prospects for a new producer appear attractive, provided that only relatively small quantities are marketed.

Two types of **tarragon** (*Artemesia dracunculus*) are known to commerce, true or French tarragon and Russian tarragon, both being relatively uncommon and difficult to grow. Production is undertaken throughout Europe and in the USA and these are also the major markets. Tarragon is one of the more expensive herbs, the fob value of French imports to the USA ranging from $3.00 to $8.00 per Kg. The prospects for a new producer of high quality French tarragon are good, provided production is not in excess of 15–25 tonnes a year.

There are many varieties of **thyme** but commercial supplies are derived mainly from *Thymus vulgaris* (garden thyme) or *T. zygis* (white thyme). Demand for thyme is growing, but it is difficult to predict future supply response, since thyme production is both geographically widespread and easily undertaken. Price fluctuations vary widely according to source and quality, but over the past decade the trend has been almost continuously upwards, and French and Spanish thyme spot prices in the USA are over $1.50 per Kg. A new producer of cultivated thyme may have difficulty competing with existing sources, particularly those collecting from the wild.

15 The broad conclusion of the report is that the overall market prospects for the major culinary herbs are good and offer a significant potential for new producers in developing countries, provided that a satisfactory quality product can be marketed at a reasonable price.

RÉSUMÉ

Le marché des herbes culinaires

Les principaux objectifs du présent rapport sont de déterminer les perspectives de marché actuelles et à plus long terme pour les principales herbes culinaires, et de donner aux fournisseurs existants et potentiels de ces herbes des informations sur les différents aspects de la commercialisation, comprenant les exigences qualitatives, les taux tarifaires, la structure du commerce et de la distribution, les quantités écoulées sur les principaux marchés, ainsi que l'emballage et le stockage. L'étude est divisée en deux parties. La première partie expose quelques aspects généraux du marché des herbes, tandis que la deuxième partie traite des aspects spécifiques de quatorze des principales herbes culinaires qui sont dans le commerce international.

Les conclusions générales du rapport sont les suivantes:

1 La plupart des herbes culinaires sont indigènes des zones tempérées et subtropicales plutôt que des zones tropicales, mais le champ est libre pour des producteurs potentiels d'herbes culinaires, et les pays en voie de développement pourraient devenir d'importants fournisseurs pour certaines d'entre elles.

2 La demande pour les herbes augmente d'environ 10 pour cent par an, taux de croissance beaucoup plus rapide que pour la plupart des épices.

3 Des pénuries ont apparu de temps en temps pour la plupart des herbes étudiées dans le présent rapport. Les herbes pour lesquelles la demande

augmente rapidement et pour lesquelles les ruptures d'approvisionnement sont les plus fréquentes comprennent le basilic, l'aneth, la marjolaine, l'origan, le persil, la menthe verte et l'estragon.

4 La demande augmente dans chaque secteur du marché (secteur ménager, alimentation/industrie et alimentation/services), mais c'est dans les deux derniers que la plus forte augmentation est évidente, reflétant la popularité croissante des aliments-service et l'augmentation du nombre de gens qui mangent hors de chez eux.

5 Au cours des années 1970, le prix des herbes a augmenté, et tous les milieux commerciaux s'attendent à la continuation de cette tendance générale, ainsi qu'à d'importantes fluctuations des prix par suite des modifications des niveaux de production.

6 Une proportion croissante du marché des herbes se fournit avec une production cultivée, plutôt qu'avec la cueillette des herbes sauvages. A court terme, on s'attend à une intensification des difficultés d'approvisionnement, car la production des herbes dans les régions de culture traditionnelles en Europe devient de moins en moins économique avec les techniques existantes, en raison des hausses des prix de la terre et de la main-d'oeuvre. Mais à plus long terme, les hausses de prix prolongées pourraient aboutir à des méthodes de production plus intensives dans les pays consommateurs, et même si les coûts unitaires demeuraient plus élevés que dans les pays en voie de développement, cela pourrait être contrebalancé par une qualité supérieure et par des économies sur les frais de transport. La proportion 'faible valeur/gros volume en vrac' pour la plupart des herbes fait des charges de transport un facteur important.

7 Les principaux pays consommateurs d'herbes deviennent plus conscients de la qualité, et les exigences qualitatives sont susceptibles de devenir plus strictes, notamment en ce qui concerne la propreté et l'emploi des herbicides, fongicides, etc.

8 En dépit de l'observation faite en (5), il y a certainement des possibilités pour de nouveaux producteurs d'herbes culinaires, mais plusieurs difficultés existent. En particulier, les herbes ne se transplantent pas toujours bien, de légères différences de climat et de sol peuvent produire des différences critiques d'arôme et d'odeur, et cela peut donc prendre quelques années pour produire des produits convenables. De plus, la récolte et le séchage des herbes pour obtenir une qualité satisfaisante nécessitent une compétence et une expérience considérables. Comme le prix d'une herbe particulière peut varier considérablement d'une année à l'autre, il est recommandé au nouveau producteur de s'efforcer de diversifier sa production dès le début, en ne produisant initialement que de petites quantités de chaque herbe.

9 Pour obtenir l'accès du marché, il est recommandé au nouveau producteur de travailler par l'entremise de négociants établis sur la place, plutôt que de vendre directement aux principaux consommateurs. Les négociants établis sont en mesure de faciliter les transactions et d'indiquer aux producteurs les exigences précises du marché en ce qui concerne le prix, la qualité, les quantités, l'emballage, etc.

10 A moins qu'un producteur ne puisse assurer une qualité excellente et constante, il est peu probable qu'il puisse commercialiser des herbes qui ont été traitées au-delà du stade initial de séchage, car, pour différentes raisons, les principaux utilisateurs préfèrent recevoir leurs herbes sous forme non broyée.

11 Bien que les herbes traitées soient soumises à des droits de douane plus élevés que les herbes non traitées, les barrières douanières ne constituent, et ne constitueront sans doute pas un obstacle majeur au commerce (voir Annexe C). Il y a des obstacles beaucoup plus sérieux que les barrières douanières, notamment les spécifications qualitatives.

12 Plusieurs importants négociants et transformateurs d'herbes on reconnu la nécessité d'encourager la production des herbes et d'assurer des approvisionnements suffisants, et ils ont donc aidé à promouvoir la production dans les pays en

voie de développement. Cette action peut prendre une grande variété de formes, telles que la fourniture de conseils techniques sur la culture et le traitement, ainsi que les investissements directs.

13 Bien qu'à la fin des années 1960 et au début des années 1970, il y ait eu, dans l'utilisation industrielle, une tendance à passer des herbes aux oléorésines correspondantes, ces dernières, à l'exception des oléorésines de graines de céleri et de sauge, ne sont pas d'un usage très répandu. Beaucoup de gens soutiennent que les oléorésines d'herbes ne reproduisent pas l'arôme naturel et qu'elles ne représentent pas encore une concurrence importante pour les herbes séchées.

14 Dans le présent rapport, on traite des herbes suivantes:

Le **basilic**, dont il existe deux principales variétés commerciales: le basilic commun (*Ocimum basilicum*) et le basilic noir à petites feuilles (*O. minimum*), moins connu. Toute la production qui va dans le commerce est cultivée, et entreprise dans le monde entier, mais particulièrement en Europe, aux Etats-Unis et en Egypte. Les Etats-Unis dominent le commerce international (ils ont importé 421 tonnes en 1976); mais la France, l'Italie et l'Allemagne Fédérale sont également des marchés assez importants. Les perspectives pour le basilic dépendent beaucoup de la poursuite de l'expansion de la cuisine italienne et de la cuisine mexicaine, dans lesquelles il est principalement utilisé. La demande doit continuer à augmenter de 10% au moins par an, et un nouveau producteur fournissant un basilic de bonne qualité à $1,00 le Kg franco bord environ devrait avoir peu de difficultés à trouver un marché.

Les feuilles de **laurier** sont une des plus importantes herbes commercialisées, et on les cueille sur un arbre toujours vert (*Laurus nobilis*). La production commerciale est centrée sur la Méditerranée, avec la Turquie comme principal exportateur, fournissant en moyenne 1.250 tonnes par an. Les exportateurs moins importants comprennent la Grèce, la Yougoslavie, le Maroc et la France. Les feuilles de laurier sont largement consommées dans toute l'Europe et l'Amérique du Nord. Les différences de qualité se traduisent par d'importantes différences de prix, avec des prix courants franco bord variant de $1,00 à $1,50 le kg. La consommation de feuilles de laurier va continuer à augmenter, mais n'importe quel nouveau producteur aura peut-être du mal à concurrencer la production turque existante.

Le **céleri** (*Apium graveolens*) est disponible sous forme de graines, de flocons et de céleri-légume, et l'oléorésine de graines de céleri est également très employée. Le céleri est cultivé dans le monde entier, et une forte proportion de la demande d'arôme de céleri est satisfaite par la production locale. L'Inde domine les exportation mondiales de graines de céleri, en fournissant une moyenne de 2.500 tonnes environ par an à plus de 50 pays, dont le plus important est les Etats-Unis. Les perspectives d'avenir pour les graines de céleri dépendent des tendances dans la production indienne.

Le **cerfeuil** (*Anthriscus cerefolium*) est une herbe culinaire mineure, mais coûteuse, et la France est le producteur, le consommateur et l'exportateur dominant. L'Allemagne Fédérale, les Pays-Bas et les Etats-Unis en consomment de petites quantités, ordinairement moins de 20 tonnes par an, et la plupart des négociants contactés paraissaient satisfaits des fournisseurs existants.

L'**aneth** est disponible commercialement sous forme de feuilles et de graines. Ce sont surtout les graines d'aneth, obtenues à partir d'*Anethum sowa,* qui vont dans le commerce international. L'Inde domine les exportations de graines d'aneth, en fournissant annuellement 900 tonnes environ, dont les Etats-Unis importent 70 pour cent environ. La consommation de feuilles d'aneth est plus faible que celle des graines d'aneth, mais elle augmente beaucoup plus rapidement. Les Etats-Unis sont le principal producteur et le principal marché pour les feuilles d'aneth, et l'Allemagne Fédérale est un autre marché important. Alors que le prix futur des graines d'aneth restera vraisemblablement franco bord à $0,50 le Kg,environ, le prix des feuilles d'aneth sera beaucoup plus élevé. La consommation future dépendra surtout de la croissance attendue de l'industrie des marinades, qui est la principale consommatrice d'aneth. La production de

feuilles d'aneth est une proposition plus intéressante que celle des graines d'aneth.

La **marjolaine** (*Marjorana hortensis*) est une importante herbe culinaire, dont la gamme d'utilisations est étendue, et qui est cultivée dans toute l'Europe et le Bassin méditerranéen, ainsi qu'en Amérique du Nord et du Sud. La France et l'Egypte sont les principaux exportateurs, mais le faible nombre de statistiques disponibles, joint au fait que l'origan est parfois vendu comme marjolaine (et vice versa) tout cela rend difficile une estimation quantitative. Les Etats-Unis consomment 300 – 400 tonnes environ par an, mais la France et l'Allemagne Fédérale sont de plus gros marchés, consommant plus de 500 tonnes. Le prix habituel franco bord pour la marjolaine se situe aux alentours de $1,30 le Kg, mais de fréquentes ruptures d'approvisionnements provoquent d'importantes variations de prix. Les perspectives de marché pour cette herbe sont bonnes, et de nouveaux producteurs seraient les bienvenus.

Les feuilles de **menthe poivrée** (*Mentha piperita*) sont largement employées à des usages médicinaux et dans la préparation des infusions de menthe, tandis que les feuilles de menthe verte (*M. spicata*) servent surtour à des usages culinaires, notamment pour les sauces à la menthe. De nombreux pays produisent de la menthe, et c'est un arôme populaire dans le monde entier. La demande augmente, et un nouveau producteur de feuilles de menthe, notamment de menthe verte, fournissant un produit de bonne qualité à $1,00 environ le Kg franco bord, n'aurait guère de mal à vendre sa production.

Le monde culinaire connaît deux types d'**origan**: le type européen (*Origanum vulgare*), dont la Grèce est le principal exportateur, et le type mexicain (*Lippia graveolens*) principalement produit et exporté par le Mexique. Ils sont surtout employés dans les pizzas et la cuisine mexicaine. Les Etats-Unis dominent la consommation, important fréquemment de Mexique et de Grèce plus de 2.000 tonnes, et plusieurs pays d'Europe sont aussi d'importants marchés. Les prix ont subi de larges fluctuations, mais le prix unitaire franco bord de l'origan grec a été constamment presque le double de celui de la variété mexicaine, sauf en 1974, lorsque les deux vinrent à manquer et que les prix dépassèrent le niveau de $2,00 le Kg. La consommation d'origan augmente probablement plus vite que celle de n'importe quelle herbe, et la production peut donc être recommandée aux nouveaux producteurs.

Le **persil** (*Petroselinum crispum*) est une herbe bien connue et largement utilisée, en partie à cause de ses emplois variés et de sa culture largement répandue. La plus grande partie du persil est consommée à l'état frais dans le pays de production, mais une proportion croissante est maintenant déshydratée. Seule une très faible proportion de la production est commercialisée à l'échelle internationale, mais le marché du persil déshydraté devrait poursuivre son expansion, et il y a certainement de la place pour un nouveau producteur, à condition qu'il puisse satisfaire aux exigences qualitatives élevées de ce marché et vendre son produit à $1,25 le Kg caf ou moins.

Le **romarin** (*Rosmarinus officinalis*), pousse à l'état sauvage, à foison, dans tout le Bassin méditerranéen, et plusieurs pays exportent leur production. Les principaux marchés sont les Etats-Unit et l'Europe. En raison de l'offre abondante, le romarin est une des herbes les moins chères et sa production ne peut être recommandée à un nouveau producteur.

Il y a de nombreuses espèces de **sauge** employées commercialement, mais celle qu'on trouve le plus communément sur le marché est *Salvia officinalis,* produite principalement en Yougoslavie et en Albanie. Beaucoup d'autres pays entreprennent aussi une certaine production de sauge. La consommation est répandue: les Etats-Unis sont, de loin, le principal consommateur, et ils sont probablement suivis par le Royaume-Uni, l'Italie, le Canada, la France et le Japon. Les prix varient suivant la qualité, mais la valeur franco bord aux Etats-Unis de la sauge yougoslave est d'environ $1,50 le Kg. Les perspectives de la sauge paraissent très bonnes, mais le succès avec lequel un nouveau producteur pourra faire irruption sur le marché dépendra beaucoup de sa capacité de fournir un produit se

rapprochant étroitement, en arôme et en flaveur, des fournitures dalmatiennes existantes.

Plusieurs espèces de **sarriette** sont produites, mais on n'en trouve sur le marché international que de faibles quantités, et la sarriette n'est, en aucun pays, un article important dans le commerce des herbes. La France et la Yougoslavie paraissent être les exportateurs importants, tandis que la France, l'Allemagne Fédérale et les Etats-Unis sont les principaux marchés. Les prix varient beaucoup, mais la valeur unitaire franco bord des importations US est d'environ $0,95 le Kg. Les perspectives pour un nouveau producteur semblent attirantes, à condition de ne commercialiser que des quantités relativement faibles.

Deux sortes d'**estragon** (*Artemisia dracunculus*) sont connues dans le commerce: l'estragon véritable (ou estragon francais) et l'estragon russe, qui sont l'un comme l'autre relativement peu communs et difficiles à cultiver. La production est entreprise dans toute l'Europe et les Etats-Unis, qui sont donc les principaux marchés. L'estragon est une des herbes les plus coûteuses: la valeur franco bord des importations de France aux USA va de $3,00 à $8,00 le Kg. Les perspectives pour un nouveau producteur d'estragon francais de haute qualité sont bonnes, à condition que sa production n'excède pas 15 – 25 tonnes par an.

Il existe de nombreuses variétés de **thym**, mais les approvisionnements du commerce viennent principalement de *Thymus vulgaris* (thym commun) ou de *T. zygis* (thym blanc). La demande pour le thym augmente, mais il est difficile de prédire la réaction de l'offre dans l'avenir, car la production de thym est à la fois géographiquement étendue et facilement entreprise. Les fluctuations des prix varient grandement suivant la source et la qualité, mais au cours des dix dernières années, la tendance a été presque continuellement à la hausse, et aux Etats-Unis, les prix sur le marché du comptant du thym français et espagnol sont supérieurs à $1,50 le Kg. Un nouveau producteur de thym cultivé aura peut-être du mal à concurrencer les sources existantes, et en particulier celles qui pratiquent la cueillette du thym sauvage.

15 La conclusion générale de présent rapport est que les perspectives globales de marché pour les principales herbes culinaires sont bonnes, et offrent un potential important pour de nouveaux producteurs dans les pays en voie de développement, à condition qu'un produit d'une qualité satisfaisante puisse être commercialisé à un prix raisonnable.

RESUMEN

El mercado de las hierbas culinarias

Los principales objetivos de este informe consisten en evaluar las perspectivas comerciales actuales y a largo plazo para las hierbas culinarias, y proporcionar a los proveedores existentes y futuros de hierbas información sobre diferentes aspectos de la comercialización, incluidos los requisitos de calidad, niveles arancelarios, estructura comercial y distributiva, niveles de utilización en los principales mercados y empaquetado y almacenamiento. El estudio se divide en dos partes. En la primera se examinan los aspectos generales del mercado de hierbas, en tanto que en la segunda se trata de los aspectos concretos de catorce de las principales hierbas culinarias que intervienen en el comercio internacional.

Las conclusiones generales del informe son las siguientes:

1 La mayoría de las hierbas culinarias son originarias de las zonas templadas y subtropicales más que de los trópicos, pero hay posibilidades para futuros productores de hierbas culinarias y los países en vías de desarrollo podrían convertirse en importantes proveedores de algunas hierbas.

2 La demanda de hierbas aumenta en un diez por ciento anual, aproximadamente, lo cual constituye un índice de crecimiento más rápido que para la mayoría de las especies.

3 De vez en cuando se han producido escaseces de la mayoría de las hierbas que se analizan en este informe. Las hierbas por las cuales aumenta rápidamente la demanda y de las cuales son más frecuentes las deficiencias de suministro incluyen la albahaca, el hinojo, mejorana, orégano, perejil, hierbabuena y estragón.

4 Aunque la demanda aumenta en cada uno de los sectores del mercado, a saber, el consumo casero, el industrial y el de servicios de alimentación, es precisamente en los dos últimos donde es evidente el mayor aumento de demanda, lo cual refleja la creciente popularidad de los alimentos preparados y el creciente número de personas que comen fuera de casa.

5 Durante el decenio en curso, ha aumentado el precio de las hierbas y todos los mercados de suministro esperan que continue esta tendencia general, junto con las amplias fluctuaciones constantes de precios, alrededor de dicha tendencia, como resultado de los cambios en los niveles de producción.

6 Una proporción creciente del mercado de hierbas culinarias se satisface con la producción cultivada más que con las hierbas silvestres. A corto plazo, se espera que se intensifiquen las dificultades de suministro a medida que la producción de hierbas en las zonas de producción tradicional de Europa, se hacen cada vez menos económicas utilizando las técnicas existentes, debido a los aumentos en los costos de mano de obra y los terrenos. Pero a largo plazo, los aumentos de precios constantes podrían conducir a que se adoptasen métodos de producción con más cantidad de maquinaria en los países consumidores e incluso aunque los costos unitarios permaneciesen más elevados que los de los países en vías de desarrollo, esto podría compensarse con la elevada calidad y los ahorros en fletes. El bajo valor y elevada relación de volumen de la mayoría de las hierbas hace que los fletes constituyan un aspecto importante.

7 Los países consumidores de hierbas más importantes están cada vez más conscientes de la calidad y los requisitos relacionados con ésta es muy probable que se hagan cada vez más estrictos, especialmente en relación con la limpieza y el empleo de herbicidas, fungicidas, etc.

8 A pesar de la observación que se hace en el párrafo (5), no cabe la duda de que hay posibilidades para nuevos productores de hierbas culinarias, pero existen varias dificultades. En particular, las hierbas no siempre se trasplantan bien y ligeras diferencias de clima y suelo pueden producir diferencias críticas en el aroma y el olor, y por lo tanto, puede tardarse varios años en obtener productos apropiados. Además, la recolección y secado de de las hierbas a un nivel satisfactorio exige bastante habilidad y conocimiento. Como el precio de una hierba determinada puede fluctuar mucho de un año a otro, se recomienda que todo nuevo productor trate de diversificar su producción desde el comienzo, produciendo en un principio sólo pequeñas cantidades de cada hierba.

9 Con objeto de conseguir acceso a los mercados, se recomienda que todo el nuevo productor trabaje a través de los comerciantes establecidos en lugar de vender directamente a los principales consumidores. Los comerciantes establecidos pueden facilitar las transacciones y comunicar al productor los requisitos exactos del mercado en relación con los precios, calidad, cantidades, empaquetado, etc.

10 A menos que un productor pueda garantizar una calidad excelente de manera constante, es poco probable que pueda vender las hierbas que haya procesado más allá de la fase inicial de secado, ya que, por varias razones, los principales usuarios prefieren recibir las hierbas en forma entera, o sea, sin picar.

11 Aunque las hierbas procesadas tienen un tipo de arancel más elevado que las hierbas sin procesar, las barreras arancelarias no constituyen ni probablemente constituirán un obstáculo importante del comercio (se hace referencia a este asunto en el Apéndice C). Hay obstáculos más graves que las barreras arancelarias, especialmente las especificaciones de calidad.

12 Varios comerciantes y procesadores importantes de hierbas han reconocido la necesidad de estimular la producción de hierbas y asegurar suministros adecuados

y han contribuido así a fomentar la producción en los países en vías de desarrollo. Esto puede tomar varias formas, tales como proveer asesoramiento técnico sobre el cultivo y la elaboración, así como sobre las inversiones directas.

13 Aunque en la utilización industrial se produjo una tendencia a eludir las hierbas y a preferir las oleorresinas correspondientes, a finales del decenio pasado y a comienzos del presente, las oleorresinas de las hierbas, a excepción de la semilla del apio y la salvia, no se utilizan muy ampliamente. Hay muchas personas que alegan que las oleorresinas de hierbas no consiguen reproducir el aroma natural y que no presentan todavía una competencia importante para las hierbas secas.

14 En este informe se trata de las hierbas siguientes:

Albahaca, de la cual hay dos variedades comerciales principales, a saber, albahaca dulce o común (*Ocimum basilium*) y la menos popular y enana o albahaca de mata (*O. minimum*). Toda la producción que entra en el comercio se cultiva y usa por todo el mundo, pero especialmente en Europa, los Estados Unidos y Egipto. Los Estados Unidos dominan el mercado internacional, importando 412 toneladas en 1976, pero Francia, Italia y Alemania Occidental son también mercados de importancia. Las perspectivas para la albahaca dependen muchísimo de que sigan extendiéndose los estilos de cocina italiana y mejicana, en los cuales se usa principalmente. La demanda seguirá aumentando por los menos en un diez por ciento anual y todo nuevo productor que suministre una albahaca de buena calidad a un dolar aproximadamente por kilo fob no tendrá grandes dificultades para encontrar un mercado.

Las **hojas de laurel** son una de las hierbas comerciales más importantes y se obtienen de un árbol perenne (*Laurus nobilis*). La producción comercial se concentra en el Mediterráneo, siendo Turquia el principal exportador, que suministra un promedio de 1 250 toneladas anuales. Entre los exportadores más pequeños se incluyen Grecia, Yugoslavia, Marruecos y Francia. Las hojas de laurel se consumen ampliamente por toda Europa y América del Norte. Las diferencias de calidad conducen a amplias diferencias de precio con precios fob actuales que varían entre uno y uno y medio dólares por kilo. El consumo de hojas de laurel seguirá aumentando, pero cualquier productor nuevo puede encontrar dificultades en competir con la producción turca existent.

El **apio** (*Apium graveolens*) se obtiene como semilla de apio, copos de apio y como planta, también se emplea ampliamente una oleorresina de semilla de apio. El apio crece en todo el mundo y gran parte de la demanda de aroma de apio se satisface con la producción local. La India domina las exportaciones mundiales de semilla de apio, proveyendo por término medio unas 2 500 toneladas anuales a más de cincuenta países, el más importante de los cuales es los Estados Unidos. Las perspectivas futuras de la semilla de apio dependen de las tendencias de la producción India.

El **perifollo o cerafolio** (*Anthruscus cerefolium*) es una hierba culinaria de menor importancia pero cara y el productor, consumidor y exportador predominante es Francia. Alemania Occidental, los Países Bajos y los Estados Unidos consumen pequeñas cantidades, por regla general menos de 20 toneladas anuales, y la mayoría de los comerciantes con los que se estableció contacto parecían estar satisfechos con los proveedores actuales.

El **eneldo** se obtiene comercialmente en forma de hojas de eneldo y semillas de eneldo. En el mercado internacional entran principalmente las semillas de eneldo, que se obtienen del *Anethum sowa.* India domina las exportaciones de semilla de eneldo suministrando alrededor de 900 toneladas anuales, de las cuales los Estados Unidos importan alrededor del setenta por ciento. El consumo de hojas de eneldo es menor, pero crece mucho más rápidamente que las semillas de eneldo. Los Estados Unidos son el principal productor y mercado de hojas de eneldo, pero Alemania Occidental es otro mercado importante. Aunque el precio futuro fob de la semilla de eneldo es probable que siga siendo aproximadamente inferior a medio dólar por kilo, el precio de las hojas de eneldo será bastante más elevado. El consumo futuro dependerá mucho del crecimiento previsto de la industria de conservas en vinagre, que es la principal consumidora de productos

de eneldo. La producción de hojas de eneldo tiene un futuro más atractivo que la de semillas.

Mejorana dulce (*Marjorana hortensis*) es una hierba culinaria importante que tiene una amplia gama de aplicaciones y se cultiva por toda Europa y el Mediterráneo, así como en América del Norte y del Sur. Los principales exportadores son Francia y Egipto, pero con las escasas estadísticas disponibles, combinado con el hecho de que a veces se vende el orégano como mejorana (y viceversa) el cálculo de cantidades se hace difícil. Los Estados Unidos consumen alrededor de 300 a 400 toneladas anuales, pero Francia y Alemania Occidental son mercados más amplios que consumen más de 500 toneladas. El precio fob corriente de la mejorana es de $1,30 aproximadamente por kilo fob, pero las frecuentes escaseces de suministro producen amplias variaciones de precio. Las perspectivas del mercado para esta hierba son excelentes y los nuevos productores serían bienvenidos.

Las **hojas de hierbabuena** (*Mentha piperita*) se emplean ampliamente para fines medicinales y en la preparación de té de menta, en tanto que las hojas de *menta verde* (*M. spicata*) se usan principalmente para fines culinarios, sobre todo en las salsas de menta. Muchos países producen menta y es un aroma popular en todo el mundo. La demanda crece y un nuevo productor de hojas de menta, especialmente de menta verde, que suministre un producto de buena calidad a un precio aproximado de un dólar fob por kilo tendrá pocas dificultades para vender su producción.

El mundo culinario reconoce dos tipos de **orégano,** el tipo europeo (*Origanum vulgare*) del cual Grecia es el mayor exportador, y el tipo mejicano (*Lippia graveolens*) que produce y exporta principalmente Méjico. Los dos tipos de orégano se utilizan principalmente en las pizzas y en la cocina estilo mejicano. Los Estados Unidos dominan el consumo, a veces importando más de 2 000 toneladas de los dos países, Méjico y Grecia, en tanto que varios países europeos constituyen también mercados importantes. Los precios han fluctuado mucho, pero el valor unitario fob del orégano griego ha sido de manera consistente casi el doble que el de la variedad mejicana, excepto en 1974, cuando ambos parecieron estar escasos y los precios aumentaron por encima del nivel de dos dólares por kilo. El consumo de orégano aumenta quizás con mayor rapidez que el de ninguna otra hierba y, por consiguiente, se puede recomendar su producción a los nuevos productores.

El **perejil** (*Petroselinum crispum*) es una hierba muy conocida y ampliamente utilizada, en parte debido a sus diversas aplicaciones y extendido cultivo. La mayor parte del perejil se usa en estado natural en el país de producción, pero cada vez se deshidrata una proporción mayor para su uso en ese estado. El comercio internacional se hace con una proporción muy pequena de la producción, pero el mercado para el perejil deshidratado debe continuar extendiéndose y hay indudablemente cabida para nuevos productores, a condición de que puedan satisfacer los elevados requisitos de calidad de este mercado y vendan su producto a 1,25 dólares cfs por kilo o menos.

El **romero** (*Rosmarinus officinalis*) crece silvestre y abundantemente por toda la zona del Mediterráneo, exportando su producción varios países. Los mercados mayores son el de los Estados Unidos y Europa. Debido a la gran amplitud de suministros, el romero es una de las hierbas menos caras y no se recomienda su producción a ningún productor nuevo.

Hay numerosas especies de **salvia** que se usan comercialmente, pero la que se encuentra más corrientemente en el comercio es la *salvia officinalis,* que se produce principalmente en Yugoslavia y Albania. Otros muchos países también producen salvia. El consumo es muy difundido, siendo los Estados Unidos el mayor consumidor, con mucho, seguido probablemente del Reino Unido, Italia, Canadá, Francia y Japón. Los precios varían de acuerdo con la calidad pero el valor EU fob de la salvia yugoslava es de alrededor de 1,50 dólares por kilo. Las perspectivas para la salvia parecen ser excelentes, pero hasta dónde puede introducirse en el mercado un nuevo productor es un asunto que depende muchísimo

de su habilidad para proveer un sustituto muy próximo en cuanto a aroma y gusto respecto a los suministros actuales Dálmatas.

Se producen varias especies de **ajedrea**, pero sólo se venden pequeñas cantidades en el mercado internacional y en ningún país es un elemento importante del comercio de hierbas. Francia y Yugoslavia parecen ser los exportadores importantes, aunque los principales mercados son Francia, Alemania Occidental y los Estados Unidos. Los precios varían mucho pero el valor unitario fob de las importaciones de los Estados Unidos es de cerca de 0,95 dólares por kilo. Las perspectivas para todo nuevo productor parecen ser interesantes, a condición de que se comercialicen solamente cantidades relativamente pequeñas.

En el comercio internacional se conocen dos tipos de *estragón* (*Artemesia dracunculus*), el estragón francés o auténtico y el estragón ruso, ambos relativamente poco corrientes y difíciles de producir. La producción existe en toda Europa y en los Estados Unidos y estos dos son también los principales mercados. El estragón es una de las hierbas más caras, siendo el valor de las exportaciones francesas a los Estados Unidos entre 3,00 y 8,00 dólares por kilo. Las perspectivas para un nuevo productor de estragón francés de buena calidad son excelentes, a condición que la producción no exceda de 15 a 25 toneladas anuales.

Hay muchísimas variedades de *tomillo,* pero los suministros comerciales se derivan principalmente del *Thymus vulgaris* (tomillo de jardín) o *T. zygis* (tomillo blanco). La demanda de tomillo aumenta pero es difícil prever la futura respuesta de los suministros, ya que la producción de tomillo es muy amplia desde el punto de vista geográfico y se puede realizar fácilmente. Las fluctuaciones de precio varían mucho de acuerdo con su origen y calidad, pero en el último decenio la tendencia ha sido casi siempre ascendente de manera constante, y los precios fob del tomillo español y francés en los Estados Unidos exceden de 1,50 dólares por kilo. Todo nuevo productor del tomillo cultivado puede tener dificultad para competir con las fuentes de suministro existentes, especialmente los que hagan la recolección silvestre.

15 Las conclusiones amplias del informe son que las perspectivas generales del mercado para las principales hierbas culinarias son buenas y ofrecen unas perspectivas importantes para nuevos productores en los países en vías de desarrollo, a condición de que se pueda comercializar un producto de calidad satisfactoria a un precio razonable.

PART I

General market considerations

Chapter 1

Definitions, forms, uses and qualities of herbs

DEFINITIONS

There is no standard definition of the term 'herb' and the distinction between herbs and spices is an imprecise one. Thus, the American Spice Trade Association (ASTA), the most important body in the spice trade, uses the term 'spices' in such a way as to include herbs and aromatic seeds. Traditionally, herbs are differentiated from spices in terms of geographical origin, in that herbs are usually grown in temperate climates whilst spices come from the tropics. In most cases, spices are more highly aromatic and often contain larger percentages of essential oil than herbs (Heath, 1972; Rosengarten, 1973). In this report the term 'herb' is used in a broad sense to include those plants, grown mainly in temperate and mediterranean climates, whose leaves, stems and flowering tops are used, either fresh or dried, chiefly in the seasoning of foods. Some herb dealers list over 200 varieties of herbs in their catalogues, but most of these varieties are used in very small quantities for medicinal purposes, and have not been discussed in this report. The Contents lists the fourteen herbs discussed in detail in this report. The major criteria for inclusion are: that they are well-known, that they are used mainly for culinary purposes, and that some assessment of their market potential is possible.

FORMS

Herbs enter trade in several different forms. Probably the most important are the dried forms and it is these that are the major types discussed in this report. To some extent the essential oils and oleoresins of herbs can be substituted for the dried herbs as their applications are somewhat similar. In fact, from most of the herbs discussed in this report, essential oils are produced and used by the food, beverage and pharmaceutical industries as flavouring and perfuming agents. Essential oils are the volatile components of plant cells and have a characteristic fragrance. They are normally prepared by steam distillation. The uses and markets for the major herbaceous essential oils are discussed in detail in a complementary report, Robbins and Greenhalgh (1979) *The market for selected herbaceous essential oils.* G120

Herb **oleoresins** are made by percolating a volatile solvent, such as a chlorinated hydrocarbon, through the ground herb. The solvent is subsequently evaporated off and may be recycled for further extractions, the residue being the oleoresin. These extracts offer certain advantages over the natural ground herb from which they are derived, including greater uniformity and potency of the product, quality consistency, freedom from micro-organisms, more uniform dispersion of the flavour of the product and easier handling and storage. Oleoresins are frequently used dispersed on a neutral carrier, particularly salt, rusk, dextrose or sucrose, and in this form are far more convenient for use than highly concentrated liquids. These dispersed herb oleoresins are direct substitutes for the dried herb, and are sold equivalent in strength and weight to the dried herb. Some companies, par-

ticularly in the baking and processed meat industries, prefer oleoresins in this form.

As yet, herb oleoresins, with the exception of celery seed and sage, are not widely used. Some food processors hesitate to use them because of possible incompatibility with their existing recipes and production processes. Many argue that herb oleoresins in particular fail to reproduce the natural flavour, unlike spice oleoresins. During the late 1960s and early 1970s there was a noticeable increase in oleoresin production and consumption, and whilst oleoresin usage still appears to be increasing in certain areas of the food industry, herb oleoresins do not yet present significant competition for dried herbs. For further discussion of the various relative advantages and disadvantages of using the natural product, essential oil or oleoresin the reader should consult Adamson (1971) and International Trade Centre, UNCTAD/GATT (1974a; 1977), whilst specific factors influencing the largest market for oleoresins, namely the USA, are discussed on pages 30 and 31.

Herbs used for medicinal purposes are available in several forms. The simplest are the **herbal teas** widely used in Europe for various treatments, but more often, for their pleasant taste as beverages. An **extract** is a prepared form of the crude herb, using either water or alcohol, and requires professional knowledge and special equipment. **Tinctures** are extracts from herbs obtained by means of an alcoholic medium.

A large quantity of herbs are traded in a fresh form within the countries of production. However, there is negligible international trade in fresh herbs and little prospect of a new producing country participating in such a trade. Because of this, and also in view of the fact that the trade in fresh herbs is much closer in organisation and structure to the fresh vegetable trade than to the trade in dried herbs, it will not be further discussed in this report.

Where herbs, whether dried or not, are broken up—maybe as a result of cleaning operations—but not processed further, they are known as 'crude', 'unmanufactured' or 'not ground'. Most herbs enter international trade in the crude dried form, world trade in processed herbs being very small. Further processing of herbs beyond the drying stage is almost invariably undertaken in the country of consumption. After drying, herbs are prepared for use either by grinding, chopping or crushing, or by cleaning and packaging of the whole leaves, stems or flower heads. The most usual forms in which herbs are available to industrial, food service or household users are as follows:

1 **Whole leaf**: this term is used for a product which has been cleaned, but not cut or otherwise processed. All herbs discussed in this report are available in the whole form.

2 **Chopped, cut, cracked, sliced etc**: these terms refer to leaves that have been cut (rather than ground) into smaller pieces. Common particle sizes are about 3–6 mm but size is largely dependent upon buyer's specification. Basil, tarragon and sage are herbs available in the chopped or cut form.

3 **Rubbed**: a traditional term for a herb that has been subjected to only a minimum of grinding and then passed through a coarse sieve. Many users prefer this minimal processing because not only does it preserve flavour longer, but also it enables easy blending of the product to be carried out. Rubbed herbs are also referred to as **crushed** herbs, but these are not standardised terms, since the consistency can vary according to the processing procedures of the supplier. Bay (laurel) leaves and sage are available in the rubbed (crushed) form.

4 **Ground** or **finely ground**: in this case the herbs have undergone more grinding than have rubbed herbs, including pulverisation and fine sifting. There is no set particle size, this depending upon the purchaser's specification which in turn is dependent upon the use to which the herb will be put. The finer the grinding the more completely will the herb blend into the food and become less noticeable; however, the more finely powdered the herb, the more the aroma will tend

to be lost. In general, if dried material is used it should be freshly ground to conserve as many of the volatile principles as possible.

Alongside individual herbs, the major herb companies also market various made-up mixtures of herbs, mainly for the household market. One example is 'bouquet garni', which appears in many recipes and consists of a small amount of mixed herbs tied together in a muslin bag, which is removed after cooking. One bouquet garni blends parsley, thyme, oregano, rosemary and bay leaves. 'Les fines herbes' is usually a mixture of tarragon, chervil, parsley and chives which is cooked with the food and eaten, while the product sold as 'mixed herbs', though tending to vary in composition, is usually a combination of marjoram, thyme, parsley and sage.

USES

The major area of usage of the herbs discussed in this report is flavouring, seasoning and garnishing of food. Herbs improve the flavour, appearance and aroma of food. Fresh herbs invariably have a better aroma and flavour, but generally it is in the dried form that herbs are employed. Herbs also have many medicinal properties and the pharmaceutical industry uses large quantities of herbs in medicinal preparations. Currently a revival is underway in the use of herbal medicines which is part of a wider movement towards more so-called 'natural living'. This movement has also created a more widespread use of herbs for culinary purposes. Herbs are also incorporated in dietetic preparations requiring a low-sodium content, whilst some culinary herbs, particularly peppermint (*Mentha piperita*) and garden sage (*Salvia officinalis*), are used to make herbal tea mixtures, taken in the form of a decoction or as an infusion. Whilst it is claimed that herbal teas have certain medicinal properties, their major use is as refreshing beverages. Herbs are also used in perfumery and cosmetic products (eg rosemary and mint); whilst some of the culinary herbs are used for minor purposes such as decoration, masking agents for certain food and pharmaceutical products containing undesirable flavours and odours; and for numerous other purposes, including making lawns, pot-pourris, moth and insect deterrents, in dyeing and fabric cleaning, and as aphrodisiacs (Heath, 1977). The use of each particular herb will be dealt with in its individual chapter.

QUALITIES

There is no general grading system for herbs, quality considerations tending to vary from country to country and from herb to herb. The quality of herbs is dependent on several variables: plant variety, growing conditions, cultural practices, drying and processing methods, and storage and packaging. The genetic characteristics of a particular plant variety may appear to be a fairly obvious factor affecting quality, but in the past, problems for producers have arisen from mis-labelling, misunderstandings and ignorance, and also from seeds or cuttings having been of the incorrect variety and hence unsuitable for the required markets. Other important factors influencing quality, including weather, soil conditions and cultural practices, will only be touched upon briefly in this report, and it is recommended that any prospective producer should seek expert advice on these and related matters. Some of the major grinding and processing companies listed in Appendix A are willing to provide such advice. Harvesting, drying and processing techniques, along with packaging and storage, all of which have a considerable impact on quality, will be discussed in greater detail in the following chapter.

Cleanliness, flavour, colour and aroma are the most important considerations in the purchasing of herbs. So far, herb exporters have not established national quality control standards, although some countries have done so with regard to spices. As the market in traded herbs grows, both buyers and sellers are recognising the need for specific quality standards together with accepted means of

testing. Major herb and spice importing countries have developed specifications, which include definitions regarding botanical species, details relating to the correct part(s) of the plant to be used, colour and permitted levels of extraneous matter. Standards can vary and this can create problems, particularly for exporters. However, attempts are being made to standardise quality regulations. Over the past decade the various specifications have become more rigorous and this trend is almost certain to continue, particularly as consumer pressure groups become a greater force in the major importing countries. For information on the specific quality requirements for those individual herbs for which details have been defined, a prospective producer should contact one or other of the organisations listed in Appendix B.

The most stringent specifications are those imposed by the USA and, since this is the major market for traded herbs, these specifications are discussed in some detail. Initially the Food and Drug Administration (FDA) undertook the work of sampling and analysis. As the work of the FDA increased and spice and herb imports rose, an attempt was made to reach a self-regulation understanding with spice importers in order to shift the work of sampling and analysis from the FDA to various members of the industry. As a result, in 1969 the ASTA *Cleanliness Specifications for Unprocessed Spices, Seeds and Herbs (Foreign and Domestically Produced)* came into being, with revisions in 1971 and 1975. In exchange for the FDA's conditional release of herb imports without formal inspection, importers would guarantee that all shipments found by an ASTA-approved laboratory to be adulterated would either be returned to the exporting country or else be properly cleaned or reconditioned before being released into consumer channels. With the introduction of codings on consumer packs, contaminated products can be identified and recalled even from retail outlets. The ASTA specifications established limits for 'macro-filth' only, (which is removable by further processing), but they did not define the total requirements of the *Food, Drug and Cosmetic Act.* So far, the FDA and ASTA have failed to agree upon a common programme. Thus herb exporters to the USA face the 'double jeopardy' of two sets of specifications, firstly the FDA's *Defect Action Levels* published in 1972, and secondly the *ASTA Specifications.* Both sets of specifications are under constant review, and the FDA has pointed out that its Defect Action Levels will be periodically lowered as technology improves. Most people closely involved with the herb market in the USA believe that exporters will have to improve their standards of cleanliness in order to avoid in the future an even greater incidence of confiscation and reconditioning.

Chapter 2

Production, demand and prices

PRODUCTION

Herbs are obtained from both wild and cultivated plants. There is still some controversy as to which types are best, some arguing that herbs collected wild in their natural habitat have more flavour than those cultivated commercially, whereas others believe the opposite (Stary, 1973). Many culinary herbs are now cultivated with success, but some which are collected wild (eg rosemary) have so far proved uneconomic when cultivated. In most cases the demand for culinary herbs is such that collection from the wild would be totally insufficient to satisfy market requirements. In addition it is often inefficient and unprofitable for the picker. The industrial and tourist developments in the main herb producing countries, combined with the employment opportunities provided by neighbouring countries, have made labour more expensive and reduced the quantity of herbs which are collected from the wild or hand-picked. This trend is not only found in the traditional herb producing countries of the Mediterranean, but also in Eastern European countries, such as East Germany, Hungary and Bulgaria.

It is now generally accepted in the herb trade that the expected increase in demand for herbs can only be satisfied by the wider cultivation of herbs in short supply. Cultivation of herbs offers a number of advantages. Herbs grown under cultivation can give a high yield, and allow the production of plants with more consistent properties than plants growing wild. Cultivation assists crop husbandry by facilitating weeding, the control of insects and disease, and permits mechanisation, speedy and planned harvesting, quick transportation to the drying sheds and correct preparation, drying and storage of the herb, all of which help to maintain the aroma and flavour as far as possible. These advantages will become more important should the quality specifications for herbs, discussed in the previous chapter, become more stringent.

Herb production can be undertaken using either labour-intensive techniques, as for example in North Africa, or capital-intensive harvesting and processing methods, as in the USA. In the past few years herbs have been increasingly grown on a large scale, employing methods similar to those used for other field crops, including mechanical harvesting with machines specially adapted for the purpose. Production is mainly undertaken in temperate and Mediterranean countries, but if developing countries with temperate or sub-tropical climates have adequate labour resources, satisfactory cultural conditions and practices, and can produce acceptable quality herbs at competitive prices, they should be able to supply a growing proportion of the rising demand for herbs. For example, Egypt has become an important supplier of several herbs, including mint and marjoram. Moreover, many herbs are only harvested once a year and therefore the season's crop only reaches the various users in the autumn. Consequently, dried herbs bought before May or June in any year are almost certainly from the previous year's harvest. Therefore a new producer capable of supplying the market at a different period of the year would have certain marketing advantages. The peak harvest months for the major culinary herbs are shown in Appendix D.

However, one should not minimise the difficulties that a new herb producer would have to face in order to satisfy the increasingly stringent quality requirements outlined in the previous chapter. A prospective producer will need to ensure that the cuttings or seeds obtained are of the correct type and strain, because there have been several instances of seeds, bought under a certain name, proving on germination to be a different plant and unsuitable for the market. Another complicating factor is that sometimes a given plant is sold under several different names. Some crops require two or more years of care before a crop can be harvested for sale, and a particular area's climate and soil can greatly influence the aroma and flavour of a herb. A new producer must be aware of the diverse diseases and pests that can affect herbs, and the correct methods of eradication. In several markets buyers are increasingly worried about fertiliser and pesticide residues, and considerable care must be taken in the choice of them.

Whether grown wild or cultivated, only certain parts of the plant are collected for commercial use; in some cases the underground parts (eg root, rhizome, tuber or bulb) are collected, whilst in others it is the aerial parts, such as the leaf, herbage, flower, fruit or seed. In the herbs discussed in this report it is one or more of the aerial parts that are collected.

Harvesting

An important factor influencing the quality of the herb is the time at which it is harvested, since the essential oil content and therefore the aromatic and flavouring qualities, vary during the life cycle of a plant. Leaves are gathered throughout the whole growing period, although young leaves tend to be the most suitable. They are either picked singly, or else the entire stem is cut off and the leaves afterwards stripped. Leaves should be healthy, free from disease and insect pests, clean and dry, without any trace of moisture from dew or rain. The aerial or top parts of the plant (herbage) are collected with the flower-bearing stems just before, or at the beginning of the flowering stage. Usually they are cut off several centimetres above the ground. For cultivated crops use is sometimes made of specially adapted harvesting machines. In the case of older plants, where the bottom section of the stems have become woody, only the non-woody parts are collected. Fruit and seeds are collected when mature. In the case of cultivated crops which are harvested by machine, this is done just before they are fully ripe so as to avoid crumbling of the fruit or loss of the seeds. It is vitally important in harvesting herbs that they are delivered to the drying shed as quickly as possible. Care should be taken that they are not packed too tightly, and that they do not 'sweat' during transportation.

Drying

Correct and proper drying is vital for the production of a satisfactory herb which is to be traded internationally. Drying involves reducing the moisture in the harvested herb to a maximum of 5 – 10 per cent, thus minimising spoilage. If properly dried a herb will retain much of its original colour, and this is an important criterion used by purchasers to judge quality. The method of drying will depend on the species of the plant and the parts of it to be dried. A considerable quantity of herbs are dried naturally in the shade, but artificial drying is increasingly being employed since it produces, according to some sources, a superior product, retaining much more of the original flavour and avoiding a hay-like taste. Modern methods now make it possible to dry some herbs which formerly could not be satisfactorily dried by natural methods. In all cases the drying area should be spotlessly clean, free of dust, and protected from animals and other sources of contamination. The drying room should also be well ventilated, and drying should take place on rust-free steel-meshed or firm fabric-meshed frames. Handling of the herbs should be limited to the absolute minimum to avoid crumbling. In most cases the herbs should be spread in thin layers to speed drying and to prevent spoilage by moisture condensation and overheating. However, some herbs can be dried by tying the aerial parts in bunches and hanging them up to dry. Tender leaf herbs, such as basil or mint, should be dried rapidly to avoid discolouration and mould.

The duration of drying varies according to the particular plant, its level of moisture content, and the drying temperature. Flowers and leaves tend to dry more quickly than stems. The drying temperature has a vital influence on quality. If herbs are dried naturally, it is preferable that it be undertaken in the shade with good air circulation. Artificial drying in special rooms where space is limited requires higher temperatures, but for culinary herbs the temperature should not exceed 40°C because the essential oils, and hence the flavour, are often lost at higher temperatures. The moisture level of herbs varies, and the **drying ratio** expresses the weight relationship between the fresh herb and the dried herb.

As already mentioned, nearly all herbs entering international trade are in the dried form and have not been further processed. There are several reasons for this. Firstly, it is much more difficult to check the level of contamination of ground herbs, compared with crude herbs. Secondly, ground herbs lose their essential oil constituents and characteristic aroma much more rapidly, and thus cannot be stored for as long as crude or unground herbs. Thirdly, grinders argue that it is much easier to maintain quality control standards by keeping stocks of unground herbs of varying quality, and blending these to purchasers' specifications. Food manufacturers do not usually import or process herbs, but purchase them from grinders and processors to suit their own specifications (Gray, 1972). Finally, although tariffs on processed herbs are generally relatively low, they are usually higher than those on unground herbs, and this provides another incentive to import herbs in an unmanufactured form. For the above reasons, it is doubtful whether further processing beyond the initial drying stage can be undertaken by the producer—unless, of course, the domestic market is being supplied. There will also be financial and technological difficulties in establishing further processing facilities, and therefore aspects of processing beyond the drying stage will not be discussed.

Storage and packaging

Different types of storage can influence the quality of a herb considerably. Although herbs can retain their aroma and flavour for a long period if kept under correct conditions, they tend to lose their flavour a little faster than spices such as pepper, ginger, cloves etc. Dried herbs store best in the whole (or leaf) form, and consequently most buyers choose this form of storage, while still turning over their stocks fairly quickly. A further important consideration in storage is to limit contamination. Most authorities recommend storage in airtight containers in a dry, dark place at a temperature not exceeding 18°C. Heat robs herbs of their flavour whilst dampness causes ground herbs to cake and deteriorate. Satisfactory packaging materials include laminated paper bags, cardboard containers, tins or hessian (jute) sacks, as well as various containers made of other natural or artificial fibres. Most authorities recommend that herbs for the retail market should be available in small quantities, preferably in jars or packets not exceeding about 30 g, to ensure periodic replacement.

Production data

Herb production is an extremely small proportion of any country's GDP and this, combined with the fact that most herbs are cultivated on small-holdings or collected from the wild, makes accurate data on area and production very difficult to obtain. To a very limited extent trade statistics can be used as a guide to production levels but they must be treated with great caution. The trade statistics themselves may be inaccurate, but of more importance is the fact that a large proportion of production is for domestic consumption and does not enter trade statistics. Another problem is that many households grow their own herbs, and it would seem from the current widespread interest in herb gardening that this trend is increasing. There is, however, no means of estimating the level of household production. Also the supply of all herbs is subject to widespread fluctuations, mainly because of climatic influences which can have a dramatic impact on annual production levels. Thus any estimates of production levels must be treated with great caution.

duction can usually be expanded fairly quickly. Since many herbs only yield one harvest per annum their supply in the short term is relatively inelastic, but in the longer term (over a year) is much more elastic, and it is most unlikely that prices will remain at high levels for several successive seasons. Demand for herbs in the short term tends to be fairly inelastic, since users are unwilling to make sudden alterations to their consumption patterns. In the long term, however, the availability of reasonably close flavouring substitutes results in a fairly elastic demand, particularly for an individual herb.

The level of stocks can have an important influence on prices. Most of the major users of herbs try to cover their requirements from one harvest to the next, usually over a period of one year. However, when prices are low and expected to rise, buyers may purchase over and above their actual requirements, and vice versa. The major importers or dealers maintain stocks, not only to minimise the effects of price fluctuations, but also to satisfy short-term requirements. However, most users of herbs do not like to hold large quantities of stocks, partly because of the expense of holding such a low value/high bulk commodity for long periods, and partly because of deterioration problems. Overall stock levels do not appear to have any great stabilising influence on prices.

The total volume and the value of herbs traded are very small in comparison with commodities such as wheat, sugar, coffee and cocoa and, unlike these major commodities, there is no futures market for herbs to provide a guide to future price levels. Occasionally a crop is sold pre-harvest, but this is much more the exception than the rule. Prices are decided after the harvest and are dependent mainly on the volume of the crop. Quality also influences price, consumers being willing, for example, to pay more for Yugoslav sage than Turkish sage, because the former's flavour is considered superior. Quality is influenced by the quantity of extraneous matter; thus a contaminated herb, or one containing too large a proportion of stems, will command a lower price. However, it does not always follow that a producer's net receipts will be increased through further cleaning of the herb, as the extra cost of cleaning may be greater than the additional revenue received.

Prices also vary according to such items as shippers' and traders' profit margins, port and handling charges, and freight costs. Freight charges have risen considerably in recent years, and one disadvantage of herbs is their ratio of high bulk to low value, since freight charges are imposed on cubic capacity rather than value. As a result freight charges frequently account for a large proportion of the total price.

In this section some of the general factors influencing the price of herbs have been discussed. In general, herb prices are rising as a result both of increasing demand and of a general price inflation reflected in the increased costs of production, processing and freight. Although the price trend for each particular herb will be dealt with in the appropriate chapter, it is worth reiterating that an important factor influencing the price of a particular herb will be its quality. A major specification for most herbs is the percentage of volatile oil, which indicates flavour strength; the higher the volatile oil content the higher will be the price. But a higher-priced product may in fact be cheaper to the user because it will go further in flavouring the finished product. General quality specifications were discussed in Chapter 1, whilst the specific requirements for individual herbs will be discussed in the relevant chapter.

CONCLUSION

Supply difficulties are expected to increase as herb production in the traditional growing areas becomes increasingly uneconomic using existing techniques because of rising costs of labour and land. This is particularly apparent with production from herbs collected in the wild. The increasing price of herbs and more

stringent quality specifications have already encouraged more capital-intensive methods of herb production in some countries, such as the USA, the United Kingdom and West Germany. If prices rise rapidly, and quality requirements in the major American and European markets become more stringent, then new producers may face continued strong competition, especially from producers using capital-intensive techniques in the large producing/consuming countries.

Despite these developments there is certainly scope for potential new producers of culinary herbs, and developing countries could become important suppliers of some herbs. North Africa, particularly Egypt, is supplying an increasing proportion of world supplies, whilst one German company has recently begun to grow herbs, including dill and parsley, in partnership with the Kenyan Government. Although the level of wages is an important variable, one source suggested that it is the ability to grow herbs all the year round that is a more important consideration. Produce from the Kenyan project is shipped to the consuming countries by sea rather than the more expensive air-freight; freight costs now being a vital consideration. Other trading companies in the major producing countries have also attempted to develop new sources of supply but have faced economic, technical and political problems which have led in some cases to termination of the operations.

Although the spread of production to new areas should facilitate greater supply stabilisation, annual fluctuations in supply and hence in prices, may well continue to be a major problem. Therefore a new producer should be prepared for the possibility of wide price fluctuations both on a seasonal basis and, in particular, from season to season. Initially a new producer should expect to receive a price somewhat below the currently prevailing levels until his product has gained sufficient reputation in the market.

The major markets' need for clean herbs of good colour cannot be overstressed, and a new producer must be aware that quality specifications are almost certain to become more severe. Thus it should be apparent that the growing of herbs offers little encouragement to inexperienced growers who are looking for large quick returns from a small investment in time and money. Unless there is a grave shortage of the particular herb or herbs, the product must be very carefully grown and dried, to satisfy market requirements. To be successful in the long term a new producer must not only satisfy quality requirements, but also be able to supply regular quantities and to build up mutual confidence between himself and the major trading companies. To gain access to the major markets, which will be discussed in the following chapter, a new producer should work through established traders (some of whom are listed in Appendix A). These traders have developed a detailed knowledge of the market from both the production and consumption sides, and some are willing to give technical advice and may even be willing to enter a business partnership.

Chapter 3

The major markets and their structure

INTRODUCTION

This report covers markets for culinary herbs in the major industrialised countries of the Western world and in Japan. Many other countries consume substantial quantities of herbs, especially in Eastern Europe and China, but in most cases very little information is available on levels of production and consumption, and in the case of Eastern Europe and China a large proportion of local demand is satisfied by domestic sources of supply (National Academy of Sciences, 1975).

The chief difficulty in analysing the major markets for herbs is the extremely limited statistical data available on production and trade. No country has published production data and only the USA provides a detailed breakdown of herb imports, others, in the main, group herbs with other spices and seeds, making any detailed analysis of individual trends difficult. Even when trade data are available they can only provide a guide to consumption levels. In the first place, most of the major markets are temperate countries and can supply some proportion of their own requirements, either through commercial production or through individual household production, the latter having risen greatly in recent years. Secondly, some herb imports may be further processed into oleoresins and essential oils, and thus are not directly consumed as culinary herbs. Thirdly, some countries such as France and West Germany have a considerable re-export trade in herbs. As a result, the official trade data available have to be supplemented by information from major trading and processing companies to obtain some estimate of consumption levels.

Production and trade levels relating to individual herbs vary widely. For example, savory, chervil and tarragon are minor items compared with mint or sage. Moreover, the pattern of usage of individual herbs differs in different countries; for example, the United Kingdom consumes much larger quantities of mint leaves per head than France, whilst marjoram and savory are only minor items in the United Kingdom yet are consumed in large quantities in France and West Germany.

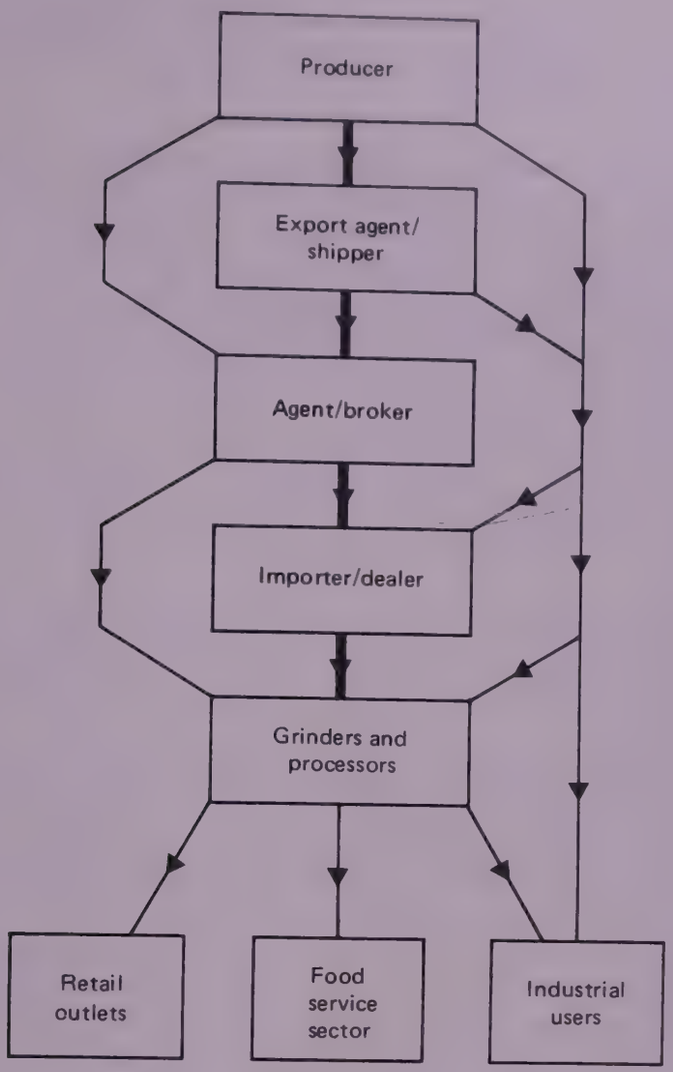
The following sections contain discussion of general aspects of the trading structure and of tariff levels. This will be followed by brief discussions of the herb markets of the USA, the UK, the Federal Republic of Germany, France, the Netherlands and Japan.

TRADE AND DISTRIBUTION

It is impossible to separate herbs and spices as far as the structure of the trade and distribution channels are concerned. Very few dealers, and no brokers, specialise solely in herbs, and the trading structure is almost identical to that described in existing reports on spices. Figure 1 summarises the most common trade and distribution channels for the Western European and American markets.

Figure 1

The typical trade channels for herbs



In Figure 1 the heavy lines indicate the most common marketing channels and these are recommended for a new producer. Briefly, the majority of herbs are handled by traders specialising in herbs and spices, as indicated above. These may be dealers or importers who act as intermediaries between shippers or producers in the country of production and the major consumers, usually spice processors and grinders. In several countries brokers or agents may act as intermediaries between importer/dealers and producers or between importer/dealers and processors, or both. The demarcation lines between these various functions are becoming more blurred. For example, importers and processors are increasingly purchasing direct from source, thus leading to a reduction in the number of brokers or agents; some importers are undertaking cleaning and grinding functions; and some of the larger food chains have recently undertaken their own importing, grinding and packing. However, smaller users generally find it convenient to buy their supplies through the specialised traders, who usually have wider knowledge of the market. Large processors still use the specialised traders for small requirements of herbs and for the servicing of additional requirements at short notice. In most instances importers and agents have a wider range of contacts than most herb processors, and can offer herbs of the required quality at competitive prices, often at short notice. Also, if any dispute arises over quality, it is usually easier to settle matters if the purchase has been arranged through a broker or importer. In some cases, users are forced to deal with specific specialised traders. For example, the Yugoslav Government has an exclusive contract with one New York broker for all herbs sold to the USA, and

the broker has an equally exclusive arrangement with a New York dealer, who also has the sole selling rights in the USA for Albanian sage. Structural changes in the organisation of trade in the producing countries are much less apparent. However, it is clear that some countries, particularly in Eastern Europe, market their produce through centralised marketing agencies or through sole agents, as in the Yugoslav example just cited.

The major brokers and importers of herbs are established in the major trading centres of the major importing countries, namely New York (USA), Hamburg (West Germany), Marseilles and Paris (France), London (UK), Tokyo (Japan) and Amsterdam and Rotterdam (Netherlands). These traders and the major processors like to establish close relationships with major suppliers both by visits and correspondence in order to obtain detailed information on expected harvests and on problems that may arise. Much of the herb trade is dependent on building up mutual trust and confidence. It is recommended that a new producer wishing to sell his product should contact an agent or importer rather than a processor, since the former will have considerable knowledge of market requirements, including individual companies and their needs. Appendix A contains a detailed list of major herb brokers and importers.

So far, few national standards exist for herbs and hence most, if not all, herbs are contracted for on the basis of samples. Several sources have complained of shipments failing to meet the standards of the sample. This may arise if the sample was sent before the harvest was properly under way, or because of adulteration, or inadequate drying. In such cases arbitration may occur, but any dispute can harm a supplier's reputation. Several of the major importing countries have developed standard contract forms, eg those drawn up by the ASTA (USA), the General Produce Brokers' Association (London) and there are also specific Netherlands and Hamburg contract forms. Each of these contracts covers such matters as arbitration, quality, price, shipment, payment and so on. Most traders prefer to quote prices cif or c. and f. port of destination, and in major trading currencies (ie dollars, Deutschmarks, sterling, French francs or yen). For a new producer there is a preference for payment only after receipt and approval of merchandise. With an established supplier payment is usually cash against documents.

When a producer has provided a satisfactory product for several years, it is then possible that herb processors and traders may sign contracts for the coming harvests, thus giving both the producer and the user greater security. As yet, the use of pre-harvest contracts does not seem to be very common, but the contracts that are negotiated usually include agreement on an approximate quantity and purchasing price, together with details regarding payment and mode of delivery. The agreement may also contain details of procedures if the harvest turns out to be below expectations.

TARIFFS

The non-tariff barriers to herb exports have already been outlined on pp 17 – 18, when quality specifications were discussed, and these present a greater restriction on trade than do formal tariff barriers. Appendix C provides details of the tariff levels on imports of herbs to the major consuming countries. On the whole, tariffs on unprocessed herbs are usually small and do not discourage trade to any appreciable extent. However, import duties on processed herbs are higher and could limit trade, although, as pointed out on pp 21, there are several other reasons why trade in processed herbs is very small.

The trend in tariffs is downwards as many developing countries can gain preferential treatment under the Generalised System of Preferences (GSP) system, as can African, Caribbean and Pacific (ACP) countries on exports to the EEC. The current 'Tokyo Round' discussions in Geneva are expected to result in a continuation of this trend.

Table 2

Estimated annual herb consumption in some major markets

Tonnes

	USA	Federal Republic of Germany	UK	Netherlands	Switzerland	Belgium	Japan
Basil	600–700	100–150	10–20	10–20	5	10	10
Bay (Laurel) leaves	300–400	200–250	75–100	60–70	5–10	30	200–300
Celery seed	1 500–2 000	100	200	75–100	...	20	150–200
Chervil	5–15	5–20	–	5–10	–	–	–
Dill herb	...	200	5	5–10	5	5	5
Dill seed	500–700	30	...	...	...	...	50
Marjoram	300–400	500–1 000	50–75	150	10–20	10–20	10–20
Mint	250	200–2 000	300–350	100	...	...	...
Oregano	2 000–2 500	200	10–20	50–60	...	10–20	20
Rosemary	200–300	200–300	25	30–50	5	5	25
Sage	1 500	50–75	250–300	20–30	5	5	20–30
Savory	70–90	150–200	10–15	15–25	2–3	2–3	...
Tarragon	40–50	10–80	10	25	2	10–15	2
Thyme	500	200–300	200	50	10–20	10–40	40–60

Source: Trade estimates

Notes: These data must be regarded as orders of magnitude rather than precise estimates. A major difficulty is the proportion of production consumed domestically, and because of this some major consumers, especially France and Italy, have not been included in the above table as the margin of error in estimation is considered to be too great. For similar reasons celery herb (leaf) and parsley have not been included

– nil or negligible

... not available

THE UNITED STATES OF AMERICA

The USA is the world's largest importer and consumer of herbs. Consumption of herbs per capita (including celery seed) increased from 18 g in 1960 to 32 g in 1972, whilst total consumption increased from 3 000 tonnes to 6 000 tonnes during the same period (Gray, 1972). In the period 1971–75 imports of herbs into the USA averaged almost 13,500 tonnes per annum, valued at nearly $5.75 million. The trend of consumption and imports has been upwards, with unit values increasing more rapidly than volume. Whilst most US requirements are met through imports, some herbs are produced domestically in commercial quantities, particularly basil, dill, parsley and celery, and also, although in smaller quantities, mint leaves, tarragon, sage, marjoram and thyme. Several sources have suggested that US domestic production, produced mainly in California, has been rising. All sources agree that the consumption of herbs is increasing at a rate faster than that of spices, the growth in annual herb consumption being estimated at around 10 per cent.

The USA is the only country that provides statistics on herb imports. Whilst US exports of herbs are not separately reported, they are believed to be very small. An estimate of recent US consumption of each herb is provided in Table 2. Within the USA there are regional and ethnic variations in herb consumption. Estimates of herb usage between the various sectors differ, but the general consensus is that 50–60 per cent is used in the retail sector, and 40–50 per cent in the industrial sector (approx 25–30%) and food service sector (approximately 15–20%) (see Table 1). The food service sector appears to be the fastest growing area of use, reflecting the growing popularity of convenience foods and the increasing number of people eating away from home. The industrial sector is the second fastest growing area. The food manufacturers do not import or grind their own herbs, but buy from the grinders and processors. The latter, besides ensuring a continuing supply of herbs, also provide other services such as the maintenance of close quality control over shipments and the blending of herbs to manufacturers' specifications, herb mixtures becoming a more important component of overall demand. Grinders also give advice on new seasoning formulations, food product development, regional tastes, evaluation of existing products, and technical advice on such problems as flavour retention and shelf-life (Dull, 1974).

An estimated 75 per cent of US imports enter the country through New York, which as a result is the centre of herb trading activities. There are some traders on the West Coast, but their turnover is relatively small. All herb imports into the USA must pass inspection by the FDA and ASTA, and sizable quantities are rejected each year because of damage or contamination. The USA has the strictest import specifications and these have been discussed in detail on p 18.

Some of the major US herb brokers, importers and processors have been listed in Appendix A. Companies which tend to specialise in herbs more than spices include V A Cordovi, M J Golanbeck, A A Sayia and Louis Furth. There are over 100 companies that clean, blend, process and package herbs, but the dominant ones are McCormick, Durkee (which has recently taken over Frank Tea and Spices), R T French and Safeway Stores.

The USA is also the largest producer and consumer of herb oleoresins, and has pioneered the use of oleoresins in food processing. The use of oleoresins is increasing, but several sources believe that the rate of growth has slowed down in recent years. In the early 1970s there was a big debate regarding spice and herb cleanliness and the FDA was very critical. Manufacturers and industrial businesses became very concerned and switched from the dried herb or spice to its essential oil or oleoresin, where possible. Future growth in oleoresin usage will be dependent on whether FDA requirements become more stringent, an event which would encourage a further switch to oleoresins. So far, the FDA requirements have mainly influenced spices rather than herbs. The major oleoresin

manufacturers all stressed that herbs are much more difficult to duplicate in the oleoresin form, since they contain flavour constituents which are much more sensitive than those found in spices. Thus for the time being dried herbs do not face great competition from their oleoresin substitutes.

FRANCE

France is probably the second most important consumer of herbs after the USA, but unfortunately very little detailed information could be obtained. Although herbs are an essential ingredient in French cooking and large quantities are produced within France, no production data are available. Most sources recognise that over the past two decades French herb production has diminished as a result of increased production costs, particularly in relation to land and labour, and of the greater remuneration obtainable from competing crops. On the other hand, most trade sources agree that herb consumption has increased and, therefore, France has had to become increasingly dependent on imported sources. However, French import statistics do not separately specify individual herbs, but group them together under the heading 'other spices'. Even if herb imports were separately specified one would still be confronted with a problem in that France is a major producer of essential oils and it is impossible to establish the quantity of herbs used for their manufacture.

Trade sources agreed that demand was increasing in all sectors of the industry, with the retail sector consuming approximately two thirds of the total, the remainder being used by the food manufacturing and catering industries (see Table 1).

In France, as elsewhere, there are two retail markets for herbs, one for the green fresh plants, which are generally not packed, and another for the dehydrated herbs sold in bottles or boxes.

Whilst dried herbs face competition in some uses from their essential oils, herb oleoresins have been very slow to gain ground in France.

THE FEDERAL REPUBLIC OF GERMANY (West Germany)

West Germany, after France, is the largest market for culinary herbs in Europe. Despite domestic production of mint, rosemary, tarragon, chervil and parsley, most of the herb market is dependent upon imported supplies. Exports of herbs are of little significance although some processors commented that, despite the small quantities involved, exports of processed herbs and seasonings are rising quickly. There is however a substantial transit trade in herbs, centred on Hamburg.

Estimates of West German consumption of individual herbs are shown in Table 2. All trade sources are agreed that demand for herbs is growing at the rate of 5 – 10 per cent per annum. Although in West Germany most of the herbs discussed in this report are used almost entirely for culinary purposes, some herbs have important uses in pharmaceuticals and herbal teas, and these outlets are growing.

West German trading firms have developed close links with Comecon countries, and a large proportion of West German imports come from this source, particularly the German Democratic Republic from which herbs enter West Germany free of any tariffs. Other important sources include France, Hungary and Yugoslavia, and in each case few problems arise with regard to reliability and quality.

Whilst Hamburg dominates the import trade in herbs and spices, several dealers in herbs are located in southern Germany, particularly Bavaria, where some

growers and processors of herbs are located. As in the case of the USA, several major processors have a preference for domestic sources of supply despite higher prices, because production is usually of a higher quality and growers or dealers are able to satisfy specific user requirements more easily. Many traders argued that for culinary herbs quality is often of greater importance than price. Quality specifications for the German market are becoming more rigorous, especially with regard to the level of contaminants and the use of herbicides and pesticides. In fact some purchasers are requesting certificates from producers stating that no contaminants, insecticides or pesticides have been employed, but it is extremely difficult or impossible to comply with such requests. Most herbs imported into Germany are re-cleaned or further processed, or both.

The major processing companies in the herb/spice trade in West Germany are Ostmann (Bielefeld), Ubena (Bremen), Alba (Bielefeld) and Fuchs (Dissen), who together account for approximately 75 per cent of retail sales.

Whilst all sources agreed that oleoresins are not much used in German industry in contrast with the position in the USA and the UK, opinions as to likely future developments varied. Some argued that prospects were not very good, partly because oleoresins were said to be unsuitable for some major uses, while others felt that the prospects in the long term would become good once manufacturers had become convinced of their relative advantages.

THE UNITED KINGDOM

The United Kingdom market for herbs is much smaller than those of the three major consuming countries, namely the USA, France and West Germany. Nevertheless, usage of and interest in both medicinal and culinary herbs have increased enormously during the 1970s. Some of the increased demand has been satisfied by home-garden production, but it is impossible to give any estimates of the volume and value of home-produced herbs. There is also a small market for fresh herbs, emanating in the main from restaurants and the catering trade, but this is unlikely to be of interest to non-UK producers.

The United Kingdom has only recently begun to record imports of some specific herbs. The limited trade data available make the estimation of likely future trends difficult, and hence one is reliant mainly on estimates from members of the trade. Table 2 shows estimated annual consumption in the UK of the major culinary herbs. These statistics must be regarded as providing orders of magnitude rather than precise measures. The most important herbs used in the UK are mint, parsley and sage, all of which are grown commercially there. Imports are needed to supplement supplies, probably in the order of 100 tonnes for mint, 150 tonnes for sage and 50 – 75 tonnes for parsley. No other herbs, with the exception of small quantities of tarragon, are grown in commercial quantities in the UK. Most mint consumed in the UK is spearmint (*Mentha spicata* and *M. viridis*), peppermint (*M. piperita*) only being used in small quantities for tea and medicinal purposes.

Within the UK there are two major outlets for culinary herbs. The first is the food manufacturing sector which consumes around 50 – 60 per cent of herbs, although the percentage is different for each herb. The major use is in stuffings, as well as in sauces and seasoning. Growth in demand is influenced by the growth of the processes and convenience food market, and estimates suggest that annual growth is about 5 – 6 per cent. Some herbs are used to make essential oils and oleoresins, but this sector is not yet very important, although it is growing. The second outlet is the retail sector, providing small packs for use in the home or bulk-packs for use in institutions and the catering trade. This is the major growth sector, estimated at around 10 – 15 per cent per annum. Two major companies supply this sector, namely Schwartz, who have approximately one third of the market, and McCormick, with approximately one fifth. Other major

suppliers include C C Spice (UK) Ltd and The British Pepper & Spice Company. As in most other major herb consuming countries, many of the larger stores and supermarkets let out floor space to these firms, who provide a merchandising service which includes restocking and the supplying of racks and advertising material. Schwartz and McCormick import most of the herbs from their North American headquarters already packed, and usually they only purchase from UK importers when in short supply. These large firms speak of a UK market size of £6 million for herbs and spices; but this provides little or no indication of quantity levels since it gives no information on packaging, advertising and merchandising. Whilst sage, parsley and mint are the most popular individual herbs, it would appear that blends of herbs are among the biggest sellers, including mixed herbs, 'fines herbes' and 'bouquet garni'.

The herb market in the UK is certainly growing, probably by 10 – 15 per cent per annum, and continuing growth is foreseen. It is difficult to make firm recommendations regarding specific herbs for the UK market, but a new producer of any herb listed in Table 2 would have little difficulty in finding a market, provided price and quality were satisfactory. Initially the larger items, such as mint, sage, parsley, thyme and bay leaves, look the most attractive, but with the expansion of demand, consumers are likely to increase more than proportionately their purchases of the lesser-known herbs.

The United Kingdom is probably the second major processor and consumer of herb oleoresins after the USA. Nevertheless the quantities produced and consumed are very small in comparison with spice oleoresins and essential oils. During the late 1960s there was a strong movement amongst all major UK food manufacturing companies away from ground herbs and spices towards oleoresins. The use of oleoresins grew rapidly, not only because of this trend but also as a result of the growth of the processed and prepared food sector. During the 1970s there has been a marked slowdown in growth and in 1978 a major oleoresin producer estimated that growth was less than 4 per cent per annum. The growth of herb oleoresin consumption is thought to be extremely small and this, combined with the reported excess capacity of oleoresin production in the UK and elsewhere, offers little encouragement to new oleoresin producers.

JAPAN

The current size of the Japanese market for the herbs covered in this report is very small (see Table 2), but the potential is great and therefore the market is discussed below in some detail. Moreover, the structure of the herb market in Japan is different from that in Europe and the USA.

The market for herbs in Japan appears to be growing at around 15 per cent per annum. This is faster than the growth in demand for spices. An approximate breakdown of usage is about 25 per cent by the retail sector, and 75 per cent by the industrial and institutional sectors, the latter undergoing the most rapid growth.

The eating habits of the Japanese are changing quickly, Western-style food having become more popular, while the development of convenience foods and the food processing industry has increased the demand for a greater range of flavours. Curry powder has become a major product of the food processing sector, and although the major ingredients of curries are spices, herbs such as sage, dill, bay leaves and thyme are also used, though in relatively small quantities. Another major food processing sector is the manufacture of ham and sausages, in which some herbs, particularly bay leaves, are employed. Household consumption is also growing quickly, partly because of the growing westernisation but also because of the increased publicity being given to herbs. For example, television cookery shows have highlighted the uses of various herbs, such as basil and thyme.

Because of the small scale of the herb trade there are no companies specialising solely in herbs. The unique Japanese trading structure arises from the existence of trading houses which have no counterparts elsewhere. The subject of trading houses is complex, partly because approximately three-quarters of Japanese trade is handled by them, and any generalisation could be misleading. Mitsubishi and Mitsui, two examples of trading companies that handle herbs, are giant industrial and commercial conglomerates, whose major concern is with 'business facilitation' ie financing, warehousing, packaging, distribution and invoicing. They offer certain advantages to an exporter of herbs to Japan, including the ability to guide products through the tortuous Japanese distribution system, as well as having offices, staffed by experienced businessmen, in most countries of the world (Norbury and Bownas, 1974). A potential exporter to Japan would certainly be well advised to contact some of the herb and spice importing and processing companies listed in Appendix A, but it could well be the case that even though a particular company might agree to purchase the herbs, the actual arrangements for shipping would be undertaken by a trading company. Direct buying is limited because the herb-processing companies feel that price fluctuations and the lack of knowledge regarding reliable shippers make it too risky.

The major herb (and spice) packers in Japan are S B Shokuhin (S B brand), House Food (House brand), Shiroya Co. Ltd (Chateau brand), and Lion Food Co. (Lion Brand). The latter has a marketing arrangement with the US company McCormick.

Japan is a producer of a number of spices and herbs, but only a few of the latter are known in the West, and for most of her supplies Japan is dependent on imports. Since the early 1970s Japan has established direct trading links with China, and the latter is becoming an important supplier of herbs to the Japanese market, a trend which is likely to continue.

Production of oleoresins in Japan is very small, although their use is increasing in the food processing industry.

Although some quality specifications exist in Japan, they are not so strict as those applying in the USA, and they are not as yet rigorously enforced. However, it is thought that they will become more stringent in the not too distant future.

OTHER MARKETS

There are many countries other than those discussed in detail in this chapter that consume sizable quantities of herbs, but in the main only very limited information is available on these markets. Several of these markets are discussed in the chapters dealing with a specific herb, and a new producer may well find it beneficial to approach agents in these countries. Countries in Western Europe that have not been dealt with but nevertheless consume significant quantities of herbs include the Netherlands, Italy, Belgium/Luxembourg, Spain, Switzerland and the Scandinavian countries.

The socialist countries of Eastern Europe (members of Comecon) are important producers and consumers of herbs. Herb consumption is thought to be growing in these countries, but industrialisation and rising labour costs are holding back herb production, and therefore, the excess available for export. On the other hand, the shortage of foreign exchange is encouraging the authorities to maintain exports at the highest possible level. As standards of living increase in Comecon countries, it could well be that the increasing demand for herbs will have to be satisfied by imports from outside Comecon countries. Ultimately import levels would largely be a matter of Government policy since State foreign trade organisations are usually responsible for the import and export of herbs from these countries.

PART II

Individual herbs

Chapter 4

Basil

INTRODUCTION

Basil belongs to the *Ocimum* genus of the Labiatae family. Two main varieties of this herb find their way into commerce, namely sweet, or common basil (*Ocimum basilium*) and dwarf, or bush basil (*O. minimum*). Both are annual herbs, believed by some to be indigenous only to the area from the Middle East to Iran, and by others to be native to Southern Asia and Africa. Basil is easy to grow in frost-free places, needing only open sun and protection from the wind for its brittle skin, and it has been grown as a medicinal plant or flavouring agent in warmer climates throughout the world for many centuries.

Sweet basil is a small bushy plant, which is profusely branching and reaches about 60 cm in height. The varieties of sweet basil include a purple-leaved one, a curly-leaved one, which may be either green or purple, and a third with a scent of citron. The glossy leaves entering commerce are usually 40 – 65 mm in length, greyish-green underneath and when crushed have a delicate, sweet, warm, highly aromatic odour. Bush basil is a low, bushy plant, seldom above 15 cm in height and the leaves seldom exceed 13 mm in length.

Most commercial production is of the sweet basil type, with yields of 20 – 25 tonnes of the fresh herb per hectare. Harvesting should be undertaken on a dry day just before flowering, and the plants are cut back part of the way to the ground, so that under favourable circumstances, as for example in California, 3 to 5 harvests per year are possible using modern capital-intensive techniques. In California the major growers undertake the harvesting, dehydration, processing and volume-packing of the herb for the major spice houses. American producers dehydrate the fresh leaves with controlled artificial heat (never exceeding 40°C) and air, taking care to preserve the aroma and the green colour. Sun-drying can also be used, but several sources suggested that, although it is much cheaper than the sophisticated machinery used in artificial drying, the succulent soft leaves do not dry as well when sun-dried, and tend to become brownish in colour.

USES AND QUALITIES

Sweet basil, with its larger leaves and richer fragrance, is much more commonly used as a culinary herb than bush basil, which is mainly employed for decorative purposes although in France and Italy this function is also combined with that of an insect repellent. Basil is one of the most popular and useful culinary herbs and figures predominantly in French, Italian and Greek cooking, being especially used in tomato-based recipes. Its most important flavouring use is as a seasoning for pizza, in which it rivals oregano, but it is also used to flavour stews, sauces, sausages, salads, turtle soup, vinegar, mustard and pickled vegetables, as well as in 'bouquet garni'. Although the herb is more pungent when fresh, it retains its flavour well when dried. Basil is used occasionally in Indian and Malaysian

cookery, but does not appear to find a large market in Asia. Nevertheless, a type of basil (*Ocimum sanctum*) is the holy 'tulsi', which Indians regard with great reverence and which is commonly cultivated near Hindu temples. The herb is also used for medicinal purposes and in snuff manufacture.

Several varieties of basil are used to produce essential oils of quite different aromatic characteristics, which are used in the formulation of compounded aromas and for flavouring sauces, condiments, vinegars, canned meats and baked goods. A dark-green semi-solid oleoresin is obtained from sweet basil, but production is negligible and offers no threat to the market for the basil herb. A tincture (20% in 60% ethanol) finds some use in liqueurs, especially Chartreuse, as a flavour modifier, but again in small quantities.

The quality characteristics for use as a culinary herb are measured by the total and acid insoluble ash contents and freedom from stems. The herb is available in the whole or ground form, whilst Parry (1969) says that the dried fragmented herb is graded fine, medium and coarse, enabling spice merchants to offer selective sizes to customers. In the USA domestically produced basil is regarded as of a superior quality to imported basil, but this has been disputed by others, who argue that, although Californian production is clean and visually attractive, its flavour does not compare with the Mediterranean type.

PRODUCTION AND TRADE

Although basil grows in the wild, all production entering international trade is cultivated. A considerable proportion of production, particularly around the Mediterranean, in India and in California, does not enter international trade, but rather is consumed domestically. For example, according to Stobart (1970), basil is grown extensively in greenhouses under tropical conditions in Genoa, Italy, and then sold fresh in the local markets.

The relative ease with which basil can be grown has led to its commercial production in many warm and temperate countries of the world. Thus in the past decade the USA, besides supplying a considerable proportion of its own needs, has imported supplies from France, Hungary, Egypt, Bulgaria, Czechoslovakia, West Germany, Poland, Yugoslavia, Belgium, Turkey, Italy, the Netherlands, Guatemala, the Lebanon, Indonesia, Pakistan and Mexico. Other countries where production is or has been undertaken are Romania, Spain, Morocco, USSR, Haiti, India and some other Asian and African countries. 'Réunion basil' is grown in the Comoro Islands and Madagascar, but production here is distilled into basil oil and no known export of the herb is undertaken.

No production data are available for any of the above-mentioned countries, but trade sources have suggested that the only commercial producers of any significance are the USA, France, Egypt, Hungary and Bulgaria. In the USA there are four producers of sweet basil, three in California and one in Arizona, each producing the larger leafed variety. Production from the latter is very small, whilst one producer (Spice Islands Inc) packages all its own production for retail sale. About 90 per cent of US production is accounted for by the two remaining producers, L O Badders & Son and San Jacinto Spice Ranch, Inc. Trade sources have estimated that domestic production is between 150 and 300 tonnes per annum, of which the largest proportion is sold at the retail level in glass packs, whilst about 40 per cent is second grade and ground mainly for use in industrial and food service applications. US production has fluctuated in recent years. The first reason for this is poor growing conditions, and further difficulties may have been encountered following the recent drought in California. A second reason was a fire at the drying plant of a major producer, leading to a 50 per cent fall in the company's production. Nevertheless, both major US producers are endeavouring to raise production to meet the rising demand for basil in the USA.

US producers sell direct to most of the large US spice houses, nothing being exported direct. Producers do not have long-term contracts, but rather have built up a close relationship with their major customers and produce to the latter's requirements. If there is a shortfall in production then available production is allocated between customers.

Levels of production outside the USA are impossible to ascertain. Sources have suggested that French production is falling because of labour shortages, but French exports to the USA have risen rapidly in the 1970s, suggesting either a growth in re-exports or a rise in domestic production (see Table 3). Most sources agree that Egyptian production has risen rapidly in recent years, and this would seem to be confirmed by US import statistics in Table 3. Nevertheless, one major broker has suggested that the recent increase in Egyptian production may have been over-estimated because Egypt is now selling direct to consuming countries, rather than selling most of its production to France for subsequent re-export. Estimates suggest that current Egyptian production levels are of the order of 600 – 700 tonnes.

An initial glance at US import data might suggest that Eastern European production of basil, particularly that from Hungary and Bulgaria, has been falling in recent years. The extensive drought in 1976 almost certainly reduced production throughout Europe. However, it could well be that domestic consumption has been increasing in Eastern Europe, thus limiting exports.

MARKETS

The United States of America

The USA dominates international trade in basil. As Table 3 shows, imports have risen from 19 tonnes in 1964 to 412 tonnes in 1976, representing an average annual rate of growth of almost 30 per cent. The high level of imports in 1976 may have reflected a need to make good the shortage of domestic production arising from the fire at a major drying plant, since in the following year exports fell to 376 tonnes. Nevertheless, using a three-year moving average, annual growth in the decade 1967 – 76 averaged almost 24 per cent. Basil consumption is still continuing to grow quickly as the popularity of Mexican-style and Italian-style cooking increases, and trade sources have suggested an annual growth rate of about 15 per cent, with food service and industrial usage growing at a much faster rate than household consumption.

Although the USA has imported basil from seventeen different countries over the past decade, France and Hungary have dominated the sources of supply, along with Bulgaria (from 1970) and Egypt (from 1974). From 1964 to 1969 annual French imports averaged almost 12 tonnes a year, compared with an average of 89 tonnes during the period 1970 – 77. The most rapid increase was for 1975 and 1976, when imports were 123 and 168 tonnes respectively. It is doubtful whether the increased exports by France represent increasing production, since several sources have suggested that 'French' basil often consists of blends of imports from different sources which are then re-exported.

Since 1964 the volume of Hungarian basil exports to the USA has exceeded those of France in nine separate years, but Hungarian imports have shown much wider annual fluctuations. Imports from Hungary reached a peak of 87 tonnes in 1972, since when the trend has been downwards, although it is likely that some Hungarian production has been re-exported from France. Imports from Bulgaria, which only began in 1970, have also fluctuated widely, with a peak of 71 tonnes in 1972 and lows of 10 tonnes in 1975 and 1977. During the 1970s several other European countries, including West Germany, Czechoslovakia, Poland, Yugoslavia, Belgium, Turkey and the Netherlands, have supplied the US market with small quantities. It is also worth noting that two Asian countries have provided supplies, namely Indonesia, with 10 tonnes in 1967, and Pakistan with

20 tonnes in 1974. Another interesting feature is that Mexico supplied 87 tonnes in 1973, since when exports to the USA have fallen to zero.

Over 50 per cent—and according to one source as high as 70 per cent—of the US basil market is satisfied by domestic production. Most US processors believe the best quality basil is Californian grown, and hence they are willing to pay a considerable price premium for the cleaner, larger and more visually attractive Californian basil. Retail packers will generally buy US-produced basil and pack it whole. The largest proportion of basil used in the ground form is from imported sources, which may or may not be blended with some domestic production. A much higher proportion of imported basil is used in the industrial sector. Of the imported basil the largest US spice packer considered Hungarian production to be the best, whilst others favoured 'French' supplies.

Basil oleoresin offers almost no competition to the herb for flavouring uses in the US. One major oleoresin producer considers that basil oleoresin is not a good match for the natural product and that the total market is only about 2 tonnes per annum.

Europe

Basil is a much more popular ingredient of Southern European, rather than Northern European, cooking. Unlike the USA, there are no trade statistics available for any European country, and no trade estimates have been obtained for the large French and Italian markets. Despite some domestic production, **France** is probably the world's second largest market for imported basil after the USA, importing sizable quantities from Italy, Eastern Europe and Egypt. According to one important French trade source, basil is one of the herbs that has presented supply difficulties.

Although basil is not considered a major herb in **West Germany** estimates of total consumption range from 100 to 150 tonnes per year, most of which is used by the retail sector. Two major processors said that their supplies were obtained from German sources (perhaps implying through German importers), but most users quoted Hungary, Bulgaria, Egypt and France as major sources, with Hungary providing the best quality. Prices ranged from 2.50 to 4.50 DM per Kg, depending on source. Demand for basil is increasing in West Germany, but one source thought there could be supply problems as consumption in Eastern Europe increased.

Compared with Italy and France, the **United Kingdom** uses only small quantities of basil for culinary purposes. One large UK spice company does not list it in its brochure on major herbs, whilst a Government publication refers to it as 'of little or no importance', although in the past it appears to have been a favourite pot-herb. The major herb dealer in the UK suggested that 10–20 tonnes are consumed each year, supplies being obtained from Spain, France, Egypt and Hungary. Although demand is rising, basil consumption is most unlikely to rival that of major herbs such as sage, mint and parsley. In a 1973 survey only 10 per cent of housewives questioned had basil in stock, and the major UK packer of herbs and spices listed it 34th in order of popularity (according to sales). Some UK food manufacturers employ small quantities of basil oleoresin in their formulations, but since most basil is consumed by households the demand for basil oleoresin is expected to remain very small.

The **Netherlands** and **Belgium** are both consumers of basil, but in very small quantities and mainly for household use. Estimates of the Dutch market varied from 10 to 20 tonnes per annum whilst Belgian consumption is estimated at 10 tonnes. Imports are obtained mostly from France but also from Egypt, Hungary and Romania. It is believed that any domestic production currently undertaken in the Netherlands or Belgium is extremely small.

Japan

In Japan basil is little used, and although demand was said to be rising rapidly it was estimated to be less than 10 tonnes per year.

PRICES

The main price data available on basil are the fob value of US imports and New York spot prices, and these are shown in Table 3. Average import prices remained relatively stable in the mid-1960s, ranging from $0.82 per Kg in 1964 down to $0.64 per Kg in 1966. Between 1968 and 1970 prices more than doubled, reaching a peak of $1.45 per Kg in 1970, since when they have fluctuated around $1.00 per Kg.

The prices received by the major producing countries have followed this trend, but 'French' basil prices have always remained above the average, reaching a peak of almost $2.00 per Kg in 1970. With the exception of 1975 and 1976, when supplies of Hungarian basil to the USA fell to pre-1970 levels, the price of Hungarian basil has been lower than French prices. The prices of Bulgarian, Egyptian and Yugoslav basil have always been considerably below those received for French and Hungarian produce, no doubt reflecting the latter's higher quality.

The price of US basil has remained relatively stable at around $2.50 per Kg. US basil producers sell fob from their plant in the West, but the largest market is in the East, where the price can be 6 – 10 cents higher than on the West Coast because of trucking costs. Prices of domestically produced basil are higher than those of imported basil, because the latter tends to be less clean, containing stems and sticks, and has not been subjected to controlled drying as in the case of US basil. One source suggested that the differential is not as high as it might initially appear when one considers the cost of having to clean the imported variety.

Finally, as is the case with most herbs, industrial users tend to pay a lower unit price because the basil they use is usually of a lower quality in terms of its visual appearance.

PROSPECTS

The future growth in demand for basil is very much dependent on the continued expansion of Italian and, to a lesser extent, Mexican styles of cooking. However, it is estimated that world consumption of basil will continue to increase by at least 10 per cent per annum, and probably by 15 per cent in the USA, the major importer of basil. The relative ease with which basil can be grown would suggest that supplies will not be a major problem, although rising labour costs in several producing countries could facilitate the entrance of a new producer onto the market. Whilst demand is estimated to expand at a fairly constant rate, supplies will continue to fluctuate in line with climatic and planting decisions, thus leading to continued price fluctuations. The success of the relatively capital-intensive basil production in the USA illustrates the willingness of spice houses to pay a considerable price premium for a high quality product. Any producer capable of producing good quality basil at $1.00 per Kg should have little difficulty in finding a market in Europe or the USA.

Table 3

Basil: imports into the USA and spot prices

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975[a]	1976[a]	1977[b]	1978
TOTAL	Tonnes	18.9	24.5	62.5	45.3	60.2	57.2	114.0	133.0	215.1	290.6	236.8	224.6	412.3	376.1	...
	$'000[c]	15.5	16.0	40.3	35.0	39.9	74.9	165.3	153.2	238.7	279.8	246.3	265.9	410.0	420.6	...
	$/Kg	0.82	0.65	0.64	0.77	0.66	1.31	1.45	1.15	1.10	0.96	1.04	1.18	0.99	1.12	...
of which from:																
France	Tonnes	11.1	5.5	10.4	–	9.3	34.2	26.1	37.3	43.2	56.3	47.2	123.1	166.7	209.3	...
	$'000	9.4	4.4	7.9	–	10.0	49.7	50.9	52.9	56.6	69.2	60.2	149.4	188.7	263.4	...
	$/Kg	0.85	0.80	0.76	–	1.07	1.45	1.95	1.41	1.31	1.23	1.28	1.21	1.13	1.26	...
Hungary	Tonnes	3.8	19.0	44.9	35.2	26.0	10.9	28.6	41.3	87.4	83.6	52.0	25.2	38.0	29.2	...
	$'000	2.7	11.6	27.3	22.2	14.1	13.4	42.7	57.2	107.7	98.5	56.1	38.0	52.4	34.2	...
	$/Kg	0.71	0.61	0.61	0.63	0.54	1.23	1.49	1.38	1.23	1.18	1.08	1.51	1.38	1.17	...
Egypt	Tonnes	–	–	–	–	–	–	–	7.0	5.0	3.1	43.0	53.1	150.3	120.1	...
	$'000	–	–	–	–	–	–	–	5.4	4.7	2.7	54.4	52.6	124.3	106.4	...
	$/Kg	–	–	–	–	–	–	–	0.77	0.94	0.87	1.27	0.99	0.83	0.89	...
Bulgaria	Tonnes	–	–	–	–	–	–	34.4	23.5	71.0	31.7	45.5	9.7	41.3	10.0	...
	$'000	–	–	–	–	–	–	26.7	17.1	62.5	24.7	30.2	5.2	20.4	5.6	...
	$/Kg	–	–	–	–	–	–	0.78	0.73	0.88	0.78	0.66	0.54	0.49	0.56	...
Yugoslavia	Tonnes	–	–	1.9	–	21.7	9.1	10.5	4.9	–	14.3	–	2.0	1.0	0.6	...
	$'000	–	–	1.1	–	13.0	6.3	11.3	6.3	–	10.0	–	1.9	0.9	0.4	...
	$/Kg	–	–	0.58	–	0.60	0.69	1.08	1.29	–	0.70	–	0.95	0.90	0.67	...
Federal Republic of Germany	Tonnes	–	–	–	–	–	1.4	6.0	3.9	4.9	5.2	0.2	0.7	0.2	–	...
	$'000	–	–	–	–	–	1.0	11.9	4.3	5.8	5.4	0.3	5.7	1.8	–	...
	$/Kg	–	–	–	–	–	0.71	1.98	1.10	1.18	1.04	1.50	8.14	9.00	–	...
Mexico	Tonnes	–	–	–	–	1.4	–	–	–	3.6	86.5	5.9	–	–	–	...
	$'000	–	–	–	–	0.7	–	–	–	1.0	56.4	3.8	–	–	–	...
	$ Kg	–	–	–	–	0.50	–	–	–	0.28	0.65	0.64	–	–	–	...
Other countries	Tonnes	4.0	–	5.3	10.1	1.8	1.6	8.4	15.1	–	9.9	43.0	10.8	14.8	6.9	...
	$'000	3.4	–	4.0	12.8	2.1	4.5	21.8	10.0	0.4	12.9	41.3	13.1	21.5	10.6	...
Approximate New York spot prices as of early March ($/Kg)																
Bulgarian		...	...	...	...	...	...	...	1.54	1.21	1.10	1.06	1.12	1.21	1.21	...
Hungarian		...	...	...	...	...	...	...	2.09	1.81	1.50	1.59	...	...	...	1.57

Source: USDA, Foreign Agriculture Circular, Tea and Spices, various issues

Notes: (a) In 1975 and 1976 the USA imported small quantities of processed basil (less than 1 tonne), but these are not included
(b) Preliminary
(c) Market value in country of origin, exclusive of import duty (if any), freight and insurance charges

Chapter 5

Bay (laurel) leaves

INTRODUCTION

Bay leaves, less commonly known as laurel leaves, are the dried leaves of *Laurus nobilis* (Family Lauraceae), an evergreen tree which grows mainly in Mediterranean countries. It is also found in China, but the variety of tree is different and yields an oil with a relatively high phenolic content, not unlike West Indian bay. Laurel bay must not be confused with the West Indian bay (*Pimenta racemosa*, formerly called *Myrcia acris*), which is a small wild tree with large leathery leaves which are the source of the West Indian bay oil and bay rum. Laurel bay is also sometimes confused with cherry laurel (*Prunus laurocerasus*), which has similar evergreen leaves but is poisonous.

The laurel bay tree is an evergreen that grows to a height of 15 – 18 m and has a smooth olive green or reddish bark. The aromatic leaves are stiff and brittle, their smooth upper surfaces being thick, dark green and slightly shiny, whilst the underside is a pale yellowish-green. The leaves are elliptical and up to 75 mm in length, and may be plucked at any time. The aroma of the leaves is delicate, fragrant and faintly anise-like, whilst the taste is aromatic and slightly bitter. Propagation is by cuttings which do not appear to be readily available. Bay can be grown in most soils, but it prefers a rich well-drained soil and a sunny sheltered place. Harvesting is by hand, usually during the early part of the day, and drying of the leaves should take place in thin layers in a reasonably warm but sheltered place in order to preserve colour and the essential oil content. Most of the bay leaves entering trade are wild, rather than cultivated.

USES AND QUALITIES

Bay leaves are used principally in vinegar pickle which in turn is used for the packing of various meats, especially pork and lamb. They are also used in the flavouring of soups, stews, game dishes, fish, fish sauces, milk puddings, pickles and mixed pickling spice, and as a garnish for pickled meats and salad dressings. Bay leaves are also a traditional ingredient in curries, 'bouquet garni' and 'pot-pourri'. Bay leaves are used commercially in flavouring various types of canned and preserved fish, meat and vegetables. A bay leaf oleoresin is produced but its use is extremely limited, one importarit US source suggesting that less than 1 tonne per annum is produced. The bay tree is also cultivated for ornamental purposes, since it grows into a most attractive tree. Bay berries and leaves were formerly much used for medicinal purposes, but this practice has all but disappeared. Bay berries are pressed or distilled to give a thick greenish oil which is used in some liqueurs.

Bay leaves are used whole or cracked but they are mainly available in the whole form. They may be cracked before being used in various types of pickling and cooking. The quality characteristics are measured by the respective contributions of volatile oil, total and acid insoluble ash, moisture, and also freedom from

stems. There are several qualities of bay leaves, the major ones being hand-picked selected and 'FAQ' (Fair Average Quality). The hand-picked are selected, after drying, for size and uniformity of colour and configuration. Size is not as critical for selected leaves but broken, insect-infested or damaged leaves are eliminated to a large extent. 'FAQ', the lowest grade, contains some leaves of irregular size and shape, along with some broken leaves, and is used primarily for cutting and powdering.

PRODUCTION AND TRADE

The bay tree is said to have come from Asia Minor, but today it is cultivated in most Mediterranean countries, including Turkey, Greece, Portugal, Spain, France, Italy, Yugoslavia and Morocco.

It is also found in Asia Minor, the Far East, the Canary Islands, Belgium and the USSR, and in the mild areas of North and Central America where the leaves grow to about 12 cm.

Bay leaves are one of the most important of traded herbs and many countries list the herb separately in their trade statistics. Turkey and Greece are the two main exporters, with lesser quantities from Yugoslavia, Morocco and France, The popularity of bay leaves is illustrated by the fact that over thirty countries are listed in the Turkish and Greek export data. Turkish exports, shown in Table 4, have shown wide annual fluctuations around an upward trend. During the decade 1966 – 75 annual exports have averaged almost 1 250 tonnes, with a low of 929 tonnes in 1967 and a peak of 1 565 tonnes in 1973. Turkey exports sizable quantities of bay leaves to several countries. During the decade 1966 – 75 average annual exports were as follows:

	Tonnes
USA	279
Federal Republic of Germany	263
Poland	224
Japan	62
United Kingdom	55
Netherlands	50
Democratic Republic of Germany	48
France	46
Hungary	44
Bulgaria	35
Canada	35
Belgium/Luxembourg	30

Other countries to which Turkey has recently exported over 25 tonnes for at least one year include Sweden, Switzerland and Czechoslovakia. It is apparent from this data that the bay leaf is a popular herb in Comecon countries, but it is noticeable that in most years the fob unit price of exports to Eastern European countries has been below (and sometimes well below) the fob unit price paid by the USA and West Germany. Another feature of exports to Comecon countries is their wider annual fluctuation than exports to Western countries.

Exports of bay leaves from Greece (see Table 5) are smaller than those from Turkey, averaging 151 tonnes during the decade 1966 – 75. Greek exports fell from a peak of nearly 250 tonnes in 1966 to below 100 tonnes in the late 1960s. In the period 1970 – 72 they recovered to average around 140 tonnes and then rose rapidly to 353 tonnes in 1973, only to fall back to an average of 107 tonnes in 1974 – 75. Only Japan and, to a lesser extent, France and Poland have been fairly regular importers of Greek bay. Greek exports to Japan have been approximately one-third of her total exports, whilst exports to France, Poland and Hungary have fluctuated widely.

Yugoslav exports (Table 6) have shown a downward trend from 153 tonnes in 1966 to 43 tonnes in 1976, with an average of 111 tonnes throughout the period. Romania has been the dominant importer of Yugoslav bay leaf, again illustrating the importance of the Eastern European market. Argentina has been Yugoslavia's other main regular market, while Poland has received large quantities at irregular intervals.

Bay leaf exports from Morocco (see Table 7) were not specified separately until 1972. After a peak of 208 tonnes in 1973 exports declined sharply and were only 2 tonnes in 1976. France and Senegal have been the major markets, although Cuba imported 60 tonnes in 1974.

In contrast with the countries mentioned above, France has been a relatively stable, although small, exporter of bay leaves. Exports annually averaged 18 tonnes from 1966 to 1976 but showed a slightly rising trend during the period. It is probable that much of these were re-exports. (See Table 8.)

From the export data it is apparent that many countries are important markets for bay leaves, and several of these provide import data. The USA is probably the most important individual market and imports from 1964 to 1976 averaged almost 300 tonnes a year. The trend of imports has been slightly upwards but no rapid expansion is apparent. Turkey dominates US supply sources (see Table 9), supplying in most years over 95 per cent of her imports. Several other countries, including Greece, Portugal, Mexico, Spain, Morocco, Egypt, Yugoslavia and Indonesia, have occasionally supplied small quantities.

After the USA, West Germany is probably the second largest importer of bay leaves, with imports averaging 215 tonnes per annum in the decade 1967 – 76 (see Table 10). Turkey has dominated supply sources, providing 95 per cent of imports during the decade. No discernible trend is apparent in the level of West German imports.

Imports into the UK (see Table 11) have been separately specified only since 1973. Between 1973 and 1976 they averaged almost 90 tonnes per annum, Turkey being the dominant supplier. Much smaller quantities were also obtained from Greece, India, France, Spain and Portugal. The UK also imports small quantities of ground bay leaves, but these averaged only 5 tonnes between 1973 and 1976 (see Table 12). Imports into the Netherlands have been lower than those of the UK, averaging 54 tonnes in the period 1966 – 76, Turkey again being by far the major supplier (see Table 14). Italian and Belgian imports have been smaller still, averaging 16 and 43 tonnes respectively (see Tables 15 and 16).

French imports have been similar in volume to those of the UK, averaging 80 tonnes per annum in the period 1966 – 76. The trend of imports has been upward with a peak of 171 tonnes in 1973 and a low of 41 tonnes in 1966. In this case, however, Turkey does not appear to be a major supplier. (See Table 13)

MARKETS

The United States of America

Production of bay leaves is undertaken in California, one packing company being easily the biggest single consumer of domestically produced bay leaves. Although the domestically produced leaf is the most attractive visually, the general view in the trade is that its flavour is poor, and less than 1 per cent of all bay leaves sold in the USA is domestically produced. Turkey is the dominant supplier of the US market, as Table 9 shows, and any new producer would have to supply a product comparable to the Turkish product in size, colour, flavour, aroma and price in order to compete. Bay leaves are used both by the pickling industry and in the retail sector where appearance is of vital importance; hence the preference for the hand-picked variety, which entails a considerable increase in cost and

makes it very difficult for domestic producers to compete. Some trade sources feel that the US market is adequately supplied by existing sources, although one important processor and packer expressed the need for another source of supply. All agree that the US market for bay leaves is relatively small compared with some of the major herbs and that demand is not growing particularly quickly.

Europe

Bay is an essential ingredient in French and Mediterranean cooking. Consumption in **France** is difficult to estimate but is probably 100 – 150 tonnes per annum. Trade sources state that supplies are obtained mainly from Turkey and Greece, other suppliers being Spain, Morocco and also local producers in Provence.

Bay leaves are a popular herb in **West Germany**, consumption being of the order of 200 – 250 tonnes per annum, purchased in the main from Turkey. Preference was expressed for 'hand-picked Turkish' supplies, but the cheaper 'FAQ' was said to be the major quality imported, the price differential between the two being usually of the order of more than 100 per cent. One source re-exports supplies throughout Europe, including Austria, East Germany, Switzerland and Scandinavia. Relatively small quantities of bay leaves are used in the household sector, the majority being employed in industry, particularly as a pickling spice. Demand for bay leaves is thought to be growing, but not as rapidly as for some herbs.

Bay leaves are an important herb in the **United Kingdom** and all supplies are imported. Trade sources estimate that consumption is around 75 – 100 tonnes per annum, and growing. The food manufacturing sector is the major consumer.

Imports into the **Netherlands** are consumed mainly by the retail sector. Supplies are mainly from Turkey and Greece, and in the past were imported from Italy, but prices from this source became uncompetitive. The consensus of opinion suggests consumption of approximately 60 – 70 tonnes per annum.

The **Belgian** market, according to trade sources, is around 30 tonnes, and export statistics of the major producers would support this view. **Switzerland** consumes even smaller quantities of bay leaves, probably less than 10 tonnes, which are mainly used in the household.

Other markets

Bay leaves are the most important herb used in **Japan**, particularly in curries and soups. According to one source, the Japanese produce their own type of bay which has a flavour somewhat different from that of European types. Consumption has been estimated at 200 – 300 tonnes per year, Turkey, Greece and France being the major suppliers. For many years Greece was the major source of supply (see Table 5) but, according to trade sources, supplies in recent years have fallen and problems of fluctuating quality have increasingly been experienced. The food industry is the major user of bay, but household consumption is probably the most rapidly increasing sector.

From the tables at the end of this chapter it is apparent that several other countries import sizable quantities of bay leaves, and could therefore provide a market for a new producer. Of particular importance are the Comecon countries, including East Germany, Hungary, Romania, Bulgaria, Poland and Czechoslovakia, the consumption of the last two countries being estimated at 200 – 250 tonnes and 50 tonnes respectively. Another important market is Canada.

PRICES

Turkish bay leaves have the most delicate flavour of all and command the highest price, often selling at more than twice the price of some of the other varieties.

However, even Turkish supplies show wide price differentiation, depending on whether supplies are 'hand-picked', and therefore of the highest quality, or cracked and broken and less valuable. West German sources quoted a considerable differential between hand-picked (about 6.00 DM per Kg) and 'FAQ' (2.00 DM per Kg). French sources paid prices ranging from 3 to 5 FF per Kg according to quality. Table 9 shows the annual average fob value of US imports, which rose from $0.32 per Kg in 1964 to a peak of $1.28 per Kg in 1977. During the late 1960s prices remained relatively stable and it is only since the early 1970s that they have risen rapidly. The New York quoted spot prices for bay leaves in March of each year are also given in Table 9 and these show a similar trend, with prices rising from $0.31 per Kg in 1966 to $1.34 in 1978. The average fob price of Turkish exports shown in Table 4 rose from $0.24 per Kg in 1966 to $0.90 per Kg in 1975, with the most rapid price rise occurring in the early 1970s. It is noticeable that the USA and Canada paid a consistently higher price for Turkish bay than did other countries, which suggests that they both imported a higher proportion of the hand-picked quality.

PROSPECTS

The demand for bay leaves will continue to grow, but probably not to the same extent as the demand for some other herbs. Any new producer will have to compete with Turkish production, and although in the past, several countries, including Greece, Spain, Portugal and Yugoslavia, have tried to do so, the market has been unprepared to pay them a price equal to that of the Turkish material. Any new producer will therefore almost certainly receive a price below the prevailing Turkish price. The major outlet for a new producer would probably be Japan, followed by Europe and the USA, but bay is very widely consumed and it could well be possible to tap other markets.

Table 4

Bay leaves: exports from Turkey

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
TOTAL	Tonnes	1 120.1	928.8	1 077.5	1 150.2	1 230.3	1 473.1	1 363.8	1 565.1	1 340.8	1 207.7
	$'000	265.8	230.2	274.1	339.6	411.9	472.2	691.8	1 414.1	1 207.1	1 089.7
	$/Kg	0.24	0.25	0.25	0.30	0.33	0.32	0.51	0.90	0.90	0.90
of which to:											
USA	Tonnes	231.2	250.4	257.7	322.8	257.1	342.7	281.3	338.2	266.0	241.8
	$'000	91.9	98.1	93.2	114.0	114.9	129.9	192.8	379.3	277.7	256.0
	$/Kg	0.40	0.39	0.36	0.35	0.45	0.38	0.69	1.12	1.04	1.06
Federal Republic of Germany	Tonnes	214.0	279.4	318.5	219.2	198.4	243.7	284.0	390.0	219.9	264.5
	$'000	42.2	54.6	74.5	61.7	67.7	83.4	158.4	362.1	222.6	283.4
	$/Kg	0.20	0.20	0.23	0.28	0.34	0.34	0.56	0.93	1.01	1.07
Poland	Tonnes	219.7	–	110.0	170.0	301.0	377.0	273.2	213.5	343.0	228.0
	$'000	37.8	–	13.8	47.1	86.2	110.3	106.1	159.6	257.9	162.8
	$'Kg	0.17	–	0.13	0.28	0.29	0.29	0.39	0.75	0.75	0.71
Democratic Republic of Germany	Tonnes	49.5	54.0	73.0	5.0	71.0	34.4	40.0	26.0	75.0	55.0
	$'000	9.0	9.9	16.6	1.5	18.7	10.1	14.5	19.9	61.3	38.6
	$/Kg	0.18	0.18	0.23	0.30	0.26	0.29	0.36	0.77	0.82	0.70
France	Tonnes	57.0	88.7	55.5	61.1	28.0	61.9	45.8	10.0	6.9	41.1
	$'000	8.1	14.1	11.7	14.8	8.2	15.7	15.8	6.7	5.2	26.3
	$/Kg	0.14	0.16	0.21	0.24	0.29	0.25	0.34	0.67	0.75	0.64
Canada	Tonnes	24.2	30.5	31.3	38.9	36.4	52.2	43.0	17.2	52.0	26.5
	$'000	5.9	9.4	9.8	12.0	14.5	20.0	29.3	23.8	60.2	26.9
	$/Kg	0.24	0.31	0.31	0.31	0.40	0.38	0.68	1.38	1.16	1.02
Netherlands	Tonnes	37.2	32.1	49.7	35.4	39.5	48.5	110.3	55.0	51.5	44.5
	$'000	6.4	5.8	10.9	8.5	11.2	10.7	44.7	36.3	39.7	36.7
	$/Kg	0.17	0.18	0.22	0.24	0.28	0.22	0.41	0.66	0.77	0.82
UK	Tonnes	31.3	35.6	45.4	51.5	54.6	56.1	95.9	82.9	64.4	33.7
	$'000	5.3	7.5	10.5	13.9	15.9	18.0	46.4	69.1	64.4	33.0
	$/Kg	0.17	0.21	0.23	0.27	0.29	0.32	0.48	0.83	1.00	0.98

Table 4—*continued*

Bay leaves: exports from Turkey

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Japan	Tonnes	8.0	28.0	39.0	28.0	49.9	79.0	69.5	265.0	30.0	27.5
	$'000	1.2	5.6	8.9	7.8	14.2	19.0	27.3	208.7	24.2	40.6
	$/Kg	0.15	0.20	0.23	0.28	0.28	0.24	0.39	0.79	0.81	1.48
Belgium/Luxembourg	Tonnes	27.9	25.0	30.4	42.6	19.0	48.4	24.5	26.2	28.0	25.2
	$'000	4.3	4.6	7.1	10.6	5.1	14.2	12.1	21.0	25.4	18.1
	$/Kg	0.15	0.18	0.23	0.25	0.27	0.29	0.49	0.80	0.91	0.72
Bulgaria	Tonnes	14.0	28.0	10.0	45.0	20.0	20.0	36.5	40.0	97.5	39.9
	$'000	2.4	6.0	2.8	13.1	6.1	5.8	13.0	20.8	74.4	28.8
	$/Kg	0.17	0.21	0.28	0.29	0.31	0.29	0.36	0.52	0.76	0.72
Sweden	Tonnes	6.5	8.0	4.8	6.1	8.6	11.5	6.7	26.8	16.0	16.7
	$'000	1.8	1.5	1.8	1.6	2.2	4.6	9.6	38.8	19.5	19.0
	$/Kg	0.28	0.19	0.38	0.26	0.26	0.40	1.43	1.45	1.22	1.14
Switzerland	Tonnes	17.0	17.0	21.0	13.0	16.5	17.0	19.5	29.5	17.1	9.5
	$'000	2.8	3.2	5.0	3.1	5.4	4.7	7.8	21.7	13.7	6.9
	$/Kg	0.16	0.19	0.24	0.24	0.33	0.28	0.40	0.74	0.80	0.73
Czechoslovakia	Tonnes	35.0	21.0	11.0	20.0	36.5	25.0	7.0	–	–	30.5
	$'000	6.0	3.8	2.7	5.6	11.5	7.7	2.8	–	–	21.7
	$/Kg	0.17	0.18	0.25	0.28	0.32	0.31	0.40	–	–	0.71
Australia	Tonnes	–	5.0	3.0	12.0	6.5	5.8	17.7	11.5	10.0	9.1
	$'000	–	0.9	0.7	3.2	2.7	2.0	6.7	10.3	8.7	7.1
	$/Kg	–	0.18	0.23	0.27	0.42	0.34	0.38	0.90	0.87	0.78
Hungary	Tonnes	79.0	–	–	70.0	70.0	40.0	–	20.0	56.0	100.0
	$'000	12.6	–	–	18.9	22.6	11.5	–	23.3	45.6	73.8
	$/Kg	0.16	–	–	0.27	0.32	0.29	–	1.17	0.81	0.74
Other countries	Tonnes	68.6	26.1	17.2	9.6	17.2	9.9	8.9	13.3	7.5	14.2
	$'000	28.1	5.2	4.1	2.2	5.0	4.6	4.5	12.7	6.6	10.0

Source: Annual Foreign Trade Statistics, Turkey

Note: – nil or negligible

Table 5

Bay leaves: exports from Greece

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
TOTAL	Tonnes	241.3	94.3	87.0	95.3	139.0	159.0	126.0	353.0	114.0	100.0
	$'000	60.5	22.6	22.2	25.5	37.4	41.8	47.2	242.3	99.4	63.7
	$/Kg	0.25	0.24	0.26	0.27	0.27	0.26	0.37	0.69	0.87	0.64
of which to:											
Japan	Tonnes	32.3	58.7	55.3	59.4	46.0	48.0	90.0	157.0	–	20.0
	$'000	8.1	13.5	14.0	15.1	11.3	12.7	34.9	110.2	–	12.5
	$/Kg	0.25	0.23	0.25	0.25	0.25	0.26	0.39	0.70	–	0.63
France	Tonnes	–	–	–	–	27.0	32.0	11.0	54.0	40.0	16.0
	$'000	–	–	–	–	6.9	8.4	3.4	35.4	42.6	10.0
	$/Kg	–	–	–	–	0.26	0.26	0.31	0.66	1.07	0.63
Poland	Tonnes	65.8	–	–	–	30.0	24.0	13.0	44.0	–	–
	$'000	16.1	–	–	–	8.7	6.4	4.4	26.2	–	–
	$/Kg	0.24	–	–	–	0.29	0.27	0.34	0.60	–	--
Hungary	Tonnes	–	16.0	–	–	–	20.0	–	30.0	30.0	–
	$'000	–	4.0	–	–	–	5.2	–	22.1	23.2	–
	$/Kg	–	0.25	–	–	–	0.26	–	0.74	0.77	–
Italy	Tonnes	–	–	–	–	–	13.0	–	6.0	4.0	8.0
	$'000	–	–	–	–	–	3.4	–	4.2	3.7	5.7
	$/Kg	–	–	–	–	–	0.26	–	0.70	0.93	0.71
Netherlands	Tonnes	–	–	–	16.2	–	–	–	19.0	–	10.0
	$'000	–	–	–	5.0	–	–	–	13.5	–	5.5
	$/Kg	–	–	–	0.31	–	–	–	0.71	–	0.55
Belgium/Luxembourg	Tonnes	–	–	–	–	–	–	–	5.0	–	17.0
	$'000	–	–	–	–	–	–	–	4.2	–	12.6
	$/Kg	–	–	–	–	–	–	–	0.84	–	0.74
Federal Republic of Germany	Tonnes	–	–	–	–	–	–	–	11.0	6.0	–
	$'000	–	–	–	–	–	–	–	8.2	6.6	–
	$/Kg	–	–	–	–	–	–	–	0.75	11.0	–

Table 5—*continued*

Bay leaves: exports from Greece

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
UK	Tonnes	–	–	–	–	–	–	–	10.0	–	11.0
	$'000	–	–	–	–	–	–	–	7.4	–	7.2
	$/Kg	–	–	–	–	–	–	–	0.74	–	0.65
USSR	Tonnes	89.6	–	–	–	–	–	–	–	–	–
	$'000	23.3	–	–	–	–	–	–	–	–	–
	$/Kg	0.26	–	–	–	–	–	–	–	–	–
Czechoslovakia	Tonnes	30.0	–	–	–	–	–	–	–	–	–
	$'000	6.9	–	–	–	–	–	–	–	–	–
	$/Kg	0.23	–	–	–	–	–	–	–	–	–
Other countries	Tonnes	23.7	19.6	31.7	19.8	36.0	22.0	12.0	17.0	34.0	18.0
	$'000	6.1	5.1	8.2	5.4	10.5	5.8	4.4	10.7	23.3	10.1

Note: – nil or negligible

Sources: Bulletin Mensuel de Statistique du Commerce Extérieur, Greece and to 1971 Commerce Extérieur de la Grèce

Table 6

Bay leaves: exports from Yugoslavia

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	152.6	114.2	114.9	136.9	137.7	102.8	91.1	106.7	126.5	91.5	43.3
	$'000	49.8	33.5	28.8	37.7	39.2	32.3	29.7	61.2	121.0	66.5	33.1
	$/Kg	0.33	0.29	0.25	0.28	0.28	0.31	0.33	0.57	0.96	0.73	0.76
of which to:												
Romania	Tonnes	96.0	94.0	97.0	30.0	20.0	78.5	45.0	–	50.0	74.0	14.5
	$'000	33.5	28.1	23.8	7.2	4.8	23.6	14.0	–	36.1	52.5	9.8
	$/Kg	0.35	0.30	0.25	0.24	0.24	0.30	0.31	–	0.72	0.71	0.68
Argentina	Tonnes	5.0	15.5	17.9	25.0	18.0	23.6	14.0	22.2	41.4	9.3	13.7
	$'000	1.4	4.0	4.9	7.1	6.0	8.4	5.5	13.7	41.5	8.9	12.6
	$/Kg	0.28	0.26	0.27	0.28	0.33	0.36	0.39	0.62	1.00	0.96	0.92
Austria	Tonnes	0.7	2.7	–	2.9	2.7	0.7	1.0	1.6	1.8	1.0	–
	$'000	0.2	0.8	–	1.0	1.0	0.3	0.4	1.1	1.6	0.5	–
	$/Kg	0.29	0.30	–	0.34	0.37	0.43	0.40	0.69	0.89	0.50	–
Poland	Tonnes	49.9	–	–	76.9	93.5	–	20.0	49.9	–	–	–
	$'000	14.4	–	–	22.0	26.0	–	6.0	27.2	–	–	–
	$/Kg	0.29	–	–	0.29	0.28	–	0.30	0.55	–	–	–
Federal Republic of Germany	Tonnes	1.0	1.0	–	–	–	–	–	10.0	7.0	2.5	2.0
	$'000	0.3	0.3	–	–	–	–	–	6.4	5.3	1.7	1.4
	$/Kg	0.30	0.30	–	–	–	–	–	0.64	0.76	0.68	0.70
Italy	Tonnes	–	1.0	–	2.0	–	–	1.0	–	5.0	–	6.0
	$'000	–	0.1	–	0.4	–	–	0.3	–	4.3	–	4.8
	$/Kg	–	0.10	–	0.20	–	–	0.30	–	0.86	–	0.80
Other countries	Tonnes	–	–	–	0.1	3.5	–	10.1	23.0	21.3	4.7	7.1
	$'000	–	0.2	0.1	–	1.4	–	3.5	12.8	32.2	2.9	4.5

Note: – nil or negligible

Source: Statistics of Foreign Trade of the SFR Yugoslavia

Table 7

Bay leaves: exports from Morocco

		1972[a]	1973	1974	1975	1976
TOTAL	Tonnes	51.5	208.0	110.0	35.0	2.3
	$'000	14.5	81.3	47.6	18.4	1.1
	$/Kg	0.28	0.39	0.43	0.53	0.48
of which to:						
France	Tonnes	25.6	149.2	33.5	25.2	1.0
	$'000	6.8	56.6	13.8	13.2	0.5
	$/Kg	0.27	0.38	0.41	0.52	0.50
Senegal	Tonnes	13.7	52.9	11.9	8.7	–
	$'000	3.1	22.4	5.3	4.7	–
	$/Kg	0.23	0.42	0.45	0.54	–
Italy	Tonnes	1.9	3.9	3.4	1.2	0.6
	$'000	0.5	1.6	1.4	0.6	0.3
	$/Kg	0.26	0.41	0.41	0.50	0.50
Other countries	Tonnes	10.3	2.0	61.2	–	0.7
	$'000	4.1	0.7	27.1	–	0.3

Source: Statistiques du Commerce Extérieur, Morocco

Notes: (a) Not separately specified before 1972
– nil or negligible

Table 8

Bay leaves: exports from France

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	13.0	9.0	16.0	8.0	8.0	11.0	20.0	28.0	32.0	28.0	26.0
	$'000	14.0	13.6	16.6	15.4	7.6	15.0	21.0	33.0	42.4	49.7	43.7
	$/Kg	1.08	1.51	1.04	1.93	0.95	1.36	1.05	1.18	1.33	1.78	1.68

Source: Statistiques du Commerce Extérieur de la France

Bay leaves: imports into the USA and spot prices

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975 [a]	1976	1977 [b]	1978
TOTAL	Tonnes	342.2	199.6	242.5	234.3	300.1	318.7	252.0	259.4	386.3	374.2	302.8	268.3	380.2	369.1	...
	$'000(c)	111.0	72.7	98.2	96.0	123.2	110.6	105.9	104.7	217.0	381.6	350.3	282.6	458.3	473.1	...
	$/Kg	0.32	0.36	0.40	0.41	0.41	0.35	0.42	0.40	0.56	1.02	1.16	1.05	1.21	1.28	...
of which from:																
Turkey	Tonnes	287.0	193.8	237.5	232.3	284.7	307.8	250.9	253.5	382.4	322.8	302.0	261.6	354.9	326.9	...
	$'000	92.8	71.1	89.2	95.3	119.0	108.3	105.6	100.3	213.8	352.4	348.8	278.8	418.7	441.8	...
	$/Kg	0.32	0.37	0.38	0.41	0.42	0.35	0.42	0.40	0.56	1.09	1.15	1.07	1.18	1.35	...
Greece	Tonnes	27.3	–	5.0	–	–	–	–	–	1.0	9.6	0.5	3.3	2.5	–	...
	$'000	10.7	–	9.0	–	–	–	–	–	1.2	9.6	0.7	2.1	1.8	–	...
	$/Kg	0.39	–	1.80	–	–	–	–	–	1.20	1.00	1.40	0.64	0.72	–	...
Portugal	Tonnes	12.6	2.0	–	–	10.4	1.1	1.1	–	–	13.0	–	–	–	–	...
	$'000	3.1	0.5	–	–	2.5	0.3	0.3	–	–	5.4	–	–	–	–	...
	$/Kg	0.25	0.25	–	–	0.24	0.27	0.27	–	–	0.42	–	–	–	–	...
Yugoslavia	Tonnes	9.5	–	–	–	–	–	–	–	–	19.6	–	3.4	–	24.9	...
	$'000	2.8	–	–	–	–	–	–	–	–	8.6	–	1.7	–	14.6	...
	$/Kg	0.29	–	–	–	–	–	–	–	–	0.44	–	0.50	–	0.59	...
Federal Republic of Germany	Tonnes	–	–	–	–	–	–	–	0.9	–	–	–	–	12.8	7.4	...
	$'000	–	–	–	–	–	–	–	0.4	–	–	–	–	16.6	11.0	...
	$/Kg	–	–	–	–	–	–	–	0.4	–	–	–	–	1.30	1.49	...
Egypt	Tonnes	–	–	–	–	–	–	–	–	–	–	–	–	–	9.9	...
	$'000	–	–	–	–	–	–	–	–	–	–	–	–	–	5.7	...
	$/Kg	–	–	–	–	–	–	–	–	–	–	–	–	–	0.58	...
Indonesia	Tonnes	–	–	–	–	–	–	–	–	–	–	–	–	10.0	–	...
	$'000	–	–	–	–	–	–	–	–	–	–	–	–	21.2	–	...
	$/Kg	–	–	–	–	–	–	–	–	–	–	–	–	2.12	–	...
Other countries	Tonnes	5.8	3.8	–	2.0	5.0	9.8	–	5.0	2.9	9.2	0.3	–	–	–	...
	$'000	1.6	1.1	–	0.7	1.7	2.0	–	4.0	2.0	5.6	0.8	–	–	–	...
Approximate New York spot prices as of early March ($/Kg) Turkish		...	...	0.31	0.35	0.53	0.44	0.44	0.44	0.60	1.08	...	1.06	1.15	1.23	1.34

Source: USDA Foreign Agriculture Circular, Tea & Spices, various issues

Notes: (a) The USA imported a small quantity (0.1 tonne) of manufactured bay leaves in 1975, but this is not included
(b) Preliminary
(c) Market value in country of origin, exclusive of import duty (if any), freight and insurance charges
– nil or negligible
... not available

Table 10

Bay leaves: imports into the Federal Republic of Germany

		1967[a]	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	207.6	243.4	199.9	165.3	197.8	246.4	224.1	194.2	217.5	250.6
	$'000	49.8	63.5	61.0	54.6	76.6	140.2	255.2	239.2	317.4	322.1
	$/kg	0.24	0.26	0.31	0.33	0.39	0.57	1.14	1.23	1.46	1.29
of which from:											
Turkey	Tonnes	199.1	239.6	196.1	164.0	189.5	235.5	201.7	174.3	204.6	226.8
	$'000	45.3	60.5	57.7	51.9	70.0	132.6	232.8	215.7	295.5	289.5
	$/Kg	0.23	0.25	0.29	0.32	0.37	0.56	1.15	1.24	1.44	1.28
Other countries	Tonnes	8.5	3.8	3.8	1.3	8.3	10.9	22.4	19.9	12.9	23.8
	$'000	4.5	3.0	3.3	2.7	6.6	7.6	22.4	23.5	21.9	32.6

Source: Aussenhandel: Spezialhandel nach Waren und Ländern

Note: (a) Not separately specified before 1967

Table 11

Bay leaves (not ground): imports into the UK

		1973[a, b]	1974	1975	1976
TOTAL	Tonnes	98.3	75.1	51.3	125.7
	£'000	38.0	34.0	23.1	58.8
	$'000	93.1	79.5	51.4	106.2
	$/Kg	0.95	1.06	1.00	0.84
of which from:					
Turkey	Tonnes	69.7	47.9	37.5	103.7
	£'000	28.4	22.4	18.3	49.2
	$'000	69.7	52.3	40.7	88.8
	$/Kg	1.00	1.09	1.09	0.86
Greece	Tonnes	8.1	10.1	11.1	18.2
	£'000	2.9	3.4	4.0	6.8
	$'000	7.1	8.0	8.9	12.2
	$/Kg	0.88	0.79	0.80	0.67
India	Tonnes	3.9	–	1.9	1.9
	£'000	0.6	–	0.3	0.4
	$'000	1.4	–	0.6	0.7
	$/Kg	0.36	–	0.32	0.37
Federal Republic of Germany	Tonnes	2.0	0.7	–	0.9
	£'000	1.3	0.8	–	1.4
	$'000	3.1	1.8	–	2.6
	$/Kg	1.55	2.57	–	2.89
Other countries	Tonnes	14.6	16.4	0.8	1.0
	£'000	4.8	7.4	0.5	1.1
	$'000	11.8	17.4	1.2	1.9

Source: Trade of the UK
H.M. Customs & Excise

Notes: (a) Not separately specified before 1973
(b) From February to December 1973
– nil or negligible

Table 12

Bay leaves (other): imports into the UK

		1973[a, b]	1974	1975	1976
TOTALS	Tonnes	7.4	7.8	3.4	1.9
	£'000	1.8	2.8	3.3	3.7
	$'000	4.5	6.5	7.3	6.6
	$/Kg	0.61	0.83	2.15	3.47
of which from:					
Federal Republic of Germany	Tonnes	0.1	1.8	0.2	1.1
	£'000	0.5	0.2	0.6	2.2
	$'000	1.2	0.4	1.3	3.9
	$/Kg	12.00	0.22	6.50	3.55
India	Tonnes	0.2	5.1	–	0.6
	£'000	0.1	1.9	–	0.8
	$'000	0.2	4.5	–	1.5
	$/Kg	1.00	0.88	–	2.50
USA	Tonnes	0.1	–	–	0.1
	£'000	0.1	–	–	0.3
	$'000	0.3	–	–	0.6
	$/Kg	3.00	–	–	6.00
Other countries	Tonnes	7.0	0.9	3.2	0.1
	£'000	1.1	0.7	2.7	0.3
	$'000	2.8	1.6	6.0	0.6

Source: Trade of the UK
H.M. Customs & Excise

Notes: (a) Not separately specified before 1973
(b) From February to December 1973
– nil or negligible

Table 13

Bay leaves: imports into France

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	41.0	45.0	72,0	78.0	66.0	73.0	85.0	171.0	78.0	72.0	95.0
	$'000	7.7	9.1	18.0	21.2	17.8	20.9	30.7	68.0	49.1	51.3	61.5
	$/Kg	0.19	0.20	0.25	0.27	0.27	0.29	0.36	0.40	0.63	0.71	0.65
of which from:												
Turkey	Tonnes	–	–	–	49.0	–	–	–	–	–	–	–
	$'000	–	–	–	13.2	–	–	–	–	–	–	–
	$/Kg	–	–	–	0.27	–	–	–	–	–	–	–
Other countries	Tonnes	41.0	45.0	72.0	29.0	66.0	73.0	85.0	171.0	78.0	72.0	95.0
	$'000	7.7	9.1	18.0	8.0	17.8	20.9	30.7	68.0	49.1	51.3	61.5

Source: Statistiques du Commerce Extérieur de la France

Note: – nil or negligible

Table 14

Bay leaves: imports into the Netherlands

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	39.0	31.0	55.0	33.0	58.0	54.0	76.0	71.0	64.0	57.0	58.0
	$'000	8.6	7.2	15.5	11.6	17.7	17.7	35.5	53.7	57.6	58.9	45.0
	$/Kg	0.22	0.23	0.28	0.35	0.31	0.33	0.47	0.76	0.90	1.03	0.78
of which from:												
Turkey	Tonnes	38.0	31.0	44.0	32.0	42.0	45.0	58.0	51.0	49.0	49.0	55.0
	$'000	7.7	6.6	11.0	9.1	12.2	12.0	22.7	35.8	44.6	47.4	36.7
	$/Kg	0.20	0.21	0.25	0.28	0.29	0.27	0.39	0.70	0.91	0.97	0.67
Greece	Tonnes	–	–	–	–	–	–	–	14.0	7.0	–	–
	$'000	–	–	–	–	–	–	–	10.4	5.6	–	–
	$/Kg	–	–	–	–	–	–	–	0.74	0.80	–	–
Other countries	Tonnes	1.0	–	11.0	1.0	16.0	9.0	18.0	6.0	8.0	8.0	3.0
	$'000	0.9	0.6	4.5	2.5	5.5	5.7	12.8	7.5	7.4	11.5	8.3

Source: Maandstatistiek van de Buitenlandse Handel

Note: – nil or negligible

Table 15

Bay leaves: imports into Italy

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976(a)
TOTAL	Tonnes	23.2	22.2	7.1	9.3	20.7	15.0	7.7	21.8	14.3	15.0	16.5
	$'000	4.4	4.8	1.8	2.6	5.9	4.3	2.5	13.2	10.7	10.0	9.8
	$/Kg	0.19	0.22	0.25	0.28	0.29	0.29	0.32	0.61	0.75	0.67	0.59
of which from:												
Turkey	Tonnes	23.2	16.8	2.1	2.0	8.6	5.5	1.5	–	1.5	–	. . .
	$'000	4.4	3.5	0.5	0.5	2.4	1.6	0.6	–	1.2	–	. . .
	$/Kg	0.19	0.21	0.24	0.25	0.28	0.29	0.40	–	0.80	–	. . .
Greece	Tonnes	–	5.4	5.0	5.3	12.2	6.4	0.2	9.3	–	11.7	. . .
	$'000	–	1.3	1.3	1.6	3.5	1.9	0.1	6.9	–	7.8	. . .
	$/Kg	–	0.24	0.26	0.30	0.29	0.30	0.50,	0.74	–	0.67	. . .
Albania	Tonnes	–	–	–	–	–	3.0	3.0	8.5	7.0	1.6	. . .
	$'000	–	–	–	–	–	0.8	0.9	4.0	6.1	1.0	. . .
	$/Kg	–	–	–	–	–	0.27	0.30	0.47	0.87	0.63	. . .
Morocco	Tonnes	–	–	–	–	–	–	1.9	2.7	3.5	1.0	. . .
	$'000	–	–	–	–	–	–	0.6	1.3	1.7	0.5	. . .
	$/Kg	–	–	–	–	–	–	0.32	0.48	0.49	0.50	. . .
Other countries	Tonnes	–	–	–	2.0	–	0.1	1.1	1.3	2.3	0.7	. . .
	$'000	–	–	–	0.5	–	–	0.3	1.0	1.7	0.7	. . .

Source: Statistica Annuale del Commercio con l'Estero, to 1973, Statistica Mensile del Commercio con l'Estero 1974 onwards

Notes: (a) Preliminary
– nil or negligble
. . . not available

Table 16

Bay leaves: imports into Belgium/Luxembourg

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	37.3	30.9	31.2	48.6	21.1	60.2	35.5	46.4	59.7	52.3	53.8
	$'000	15.4	15.0	13.1	19.4	12.7	30.3	27.6	46.7	78.9	64.6	58.7
	$/Kg	0.41	0.49	0.42	0.40	0.60	0.50	0.78	1.01	1.32	1.24	1.09
of which from:												
France	Tonnes	–	–	–	–	–	–	–	–	12.2	–	–
	$'000	–	–	–	–	–	–	–	–	33.1	–	–
	$/Kg	–	–	–	–	–	–	–	–	2.71	–	–
Turkey	Tonnes	–	–	–	–	–	–	–	–	38.9	–	–
	$'000	–	–	–	–	–	–	–	–	37.8	–	–
	$/Kg	–	–	–	–	–	–	–	–	0.97	–	–
Other countries	Tonnes	37.3	30.9	31.2	48.6	21.1	60.2	35.5	46.4	8.6	52.3	53.8
	$'000	15.4	15.0	13.1	19.4	12.7	30.3	27.6	46.7	8.0	64.6	58.7

Note: – nil or negligible

Source: Bulletin Mensuel du Commerce Extérieur

Chapter 6

Celery

INTRODUCTION

Celery (*Apium graveolens*) is an annual or biennial herb that grows to approximately 30 – 60 cm high. The plant has a grooved, fleshy erect stalk, a taproot, radical and stalk leaves, hermaphroditic flowers and humped ovoid, light brown aromatic seeds which are very small (up to 2 mm diameter). The commercial celery seed, generally produced in the second year of growth, is the fruit of wild celery or 'smallage', and there are more than 1.8 million of these tiny brown seeds to the kilogram.

Present-day celery was developed by the Italians from smallage, a wild and bitter celery, the growers succeeding in breeding out the bitterness. Today, there are many horticultural varieties of celery, some of which are naturally white and usually called 'self-blanching', whilst others are green but lack bitterness. There are also summer and winter varieties, as well as varieties grown for the root such as celeriac (*Apium graveolens* var. *rapaceum*), which is a popular vegetable in Continental Europe although not elsewhere.

Celery is cultivated mainly for its swollen leaf stalks, which are normally blanched by covering with paper, boards or soil. The latter is the most economical method and also protects the plant from injury by frost. Blanching improves both the nutritional value and taste of the celery.

Propagation is by seed, growth being best in cool weather on sandy loam soil well supplied with organic matter. After the plantings of the germinated seed in the autumn, the seed is harvested during the following summer. The stalks are cut, and, after a preliminary drying in the field, the seed is threshed and thoroughly dried.

Whilst the celery plant which provides celery seed has the same botanical name as the plant providing celery flakes or diced celery, there is a distinct difference in flavour. Celery flakes, which are the dehydrated flaked leaves and stalks, have a sweet, strong, typical celery odour and flavour, whereas celery seeds have a warm, slightly bitter odour and flavour. An oleoresin is produced from both Indian and French celery seed, and this is one of the most important oleoresins on the market today.

USES AND QUALITIES

The herb and its seeds, and the essential oil and oleoresin have wide flavouring and culinery applications. The erect leaf-stalks of the plant, which are usually blanched, are a common vegetable consumed in large quantities. They can be consumed raw as a salad vegetable, or boiled, or a soup can be prepared from them. The seeds are used extensively as a condiment as well as for propagation.

They are used for the flavouring of soups, tomato dishes, sauces, pickles, fish, pastries, sauerkraut and other savory dishes, and as a garnish with cole slaw, salad dressings and pickles, and from an important ingredient of mixed spices. Celery seed is also used as a bird seed, and is reputed to have some medicinal properties. Dehydrated celery is commercially available as 10 mm stalk dice, stalk and leaf flakes, stalk and leaf granules, and powder. These various styles are used to flavour dry soups, broth base for canned tuna, casserole mixes, stuffings, soups and stewed tomatoes, and as a garnish on potato salad and meat sauces.

Several other products are produced from the celery plant and are used for flavouring purposes. Celery salt is a convenient way of combining the flavours of salt and celery in a form that has many seasoning applications. Commercial celery salt is made from fine table salt combined with ground celery seed, celery seed oleoresin, or ground dried celery stems. Crushed celery seeds are steam distilled to produce celery seed oil, whilst the leaves and stems are occasionally distilled to produce celery leaf oil, which is often of an inferior quality when compared with the seed oil. The essential oil and oleoresin are used extensively for flavouring sauces, meats, condiments and other food products. The oil is also used in liqueurs and perfumery.

Celery seed is available in the whole or ground form, or combined with salt as 'celery salt'. The quality characteristics are measured by the volatile oil, non-volatile ether extract and total and acid insoluble ash contents. In all the major markets it is the celery seed imports that most frequently fail to fulfil quality specifications. US and Canadian Government Standards require that the dried fruit (seeds) of celery shall contain 'not more than 10 per cent total ash, nor more than 2 per cent of ash insoluble in hydrochloric acid'. Agmark, the Indian spice marketing organisation, provides celery seed specifications and differentiates three qualities, namely, special, good and fair.

The only known production of celery flakes takes place in the USA, and the flakes produced are medium to dark green and about 10 mm in diameter. They are also available in granulated and powdered form. 'Celery salt', according to Canadian Standards, should be a combination of ground celery seed or ground dehydrated celery and salt, and should contain not more than 75 per cent salt, whilst 'celery pepper' substitutes ground black pepper for the salt, but should contain not more than 70 per cent pepper.

PRODUCTION AND TRADE

Celery is native to Europe, North Africa and parts of Asia, but it both grows wild and is cultivated throughout the world. Celery for use as a vegetable is grown throughout the temperate and sub-tropical regions, and occasionally in the tropics. Known commercial cultivation takes place in the USA, France, the UK, Italy, the Netherlands, Spain, Portugal, Hungary, Morocco, Mexico and Israel. The plant grown for seed is also cultivated in temperate and semi-tropical regions, and India is now the principal source of seed for distillation. World production of seeds for flavouring rather than for propagation purposes is in excess of 3 000 tonnes, much of which is distilled for the essential oil or extracted to give the oleoresin.

India dominates world exports of celery seed: these are shown in Table 17. From 1964/65 to 1976/77 exports averaged 2 210 tonnes a year, with a peak of 3 138 tonnes in 1970/71 and a low of 1 080 tonnes in 1964/65. Exports have shown wide annual fluctuations but the trend has been upwards. In the past decade Indian celery seed has been exported to over 50 countries, but by far the most important market is the USA, which imports well over half of India's exports. Other major markets include France, the UK, West Germany, Japan, the Netherlands and Canada. Sizable quantities have also been imported from Belgium, Italy, and Australia, whilst Singapore in the 1970s has also taken large quantities, in part reflecting the establishment of oleoresin production there.

Whilst India exports a substantial quantity of her total production, there is still some domestic consumption, not only for use as a condiment in Northern India, (particularly in Uttar Pradesh, Punjab and the foothills of the Himalayas, where most celery seed is produced), but also for the extraction of oil and the production of oleoresin.

In the USA celery is grown as a vegetable and for production of celery flakes, and also for seed for the vegetable seed trade. In the latter case higher prices are obtained than could be expected for seed being used solely as a condiment. Californian seed is only sold for flavouring if it is below the required germination standards. Celery on average ranks eighth in tonnage among fresh vegetables in the USA, average annual production being around 700,000 tonnes. Commercial production is concentrated in California and Florida, which produce over 75 per cent of total production (Van Arsdel and Copley, 1964). Unfortunately no published statistics on the production of dehydrated celery are available, but, according to one knowledgeable source, only one company dehydrates celery in the USA and the costs of production are substantially higher than for the imported variety. US production of celery seed for use as a condiment is very small and is estimated at less than 1 per cent of US celery seed consumption.

The only US data available are on imports of celery seeds (see Table 18), which averaged 1 615 tonnes during the period 1964 – 77. From 1964 to 1971 the trend of imports was upwards, rising from 953 tonnes to 1 907 tonnes in 1971. Since 1971 exports fell to a low of 1 515 tonnes in 1973, recovered to peak at 2 106 tonnes in 1974, and then fell back to 1 468 tonnes in 1976, rising again to 1 902 tonnes in 1977. In most years 90 per cent of US imports are from India, and hence imports from India have closely followed the trend of total imports. The only other regular supplier has been France, from whom imports have varied between 25 tonnes in 1976 and 151 tonnes in 1971. In recent years celery seed has been imported from China, imports averaging 72 tonnes between 1974 and 1977.

There are several producers of celery in Europe. In the United Kingdom production of the vegetable celery averaged 91,500 tonnes in the period 1966/67 – 1968/69, whilst the Italian celery crop was reported as 12,000 tonnes in 1968. Production of the herb or seed for use as a condiment appears to be very small. France produces a high-quality celery seed, but her production is very small and frequently her exports of local produce are supplemented by re-exports. Both East and West Germany, Hungary and the Netherlands produce celery leaf for domestic and export markets, but no official statistics are available. Finally, according to French sources Egypt has become a producer of celery seed, but no confirmation of this can be found in US import statistics.

MARKETS

The United States of America

The USA dominates the market for celery for use in flavouring. Not only does it produce substantial quantities of celery for use as a vegetable, but it is by far the major market for imported celery seed. Since the USA does not separately specify imports of celery herb, it can be assumed that imports of this item are very small. Nevertheless, some US sources suggest that the USA imports larger quantities of dehydrated celery than are produced domestically, and, although the market is small, it appears to be growing quickly. However, if prices rise sufficiently it is thought that the USA could easily increase domestic production of dehydrated celery. The USA's overseas supply sources for dehydrated celery, according to one source, include Spain, Portugal, West Germany, Morocco, Mexico and Israel.

The USA is totally dependent on imports of celery seed for use in flavouring, and import statistics would suggest an annual consumption of over 1 500 tonnes. The

seed is used in a variety of ways, particularly in industrial and household pickling of cucumbers and in sweet pickles, where the seed is used in the whole form. The pickling industry is growing and the demand for celery seed in this industry is consequently rising. Some ground celery is also used by the pickling industry as well as for the production of celery salt and as an ingredient of mixed spices. The other major use besides pickling is in the extraction of celery oleoresin, of which a high proportion is used in the soup industry. Approximately 20 per cent of celery seed consumption is attributable to oleoresin production, whilst the quantities of essential oil produced from celery seed remain relatively small. Since the late 1960s celery oleoresin has rapidly replaced the seed in its food manufacturing uses, but it seems that the pattern of usage has now stabilised. US consumption of celery seed also appears to be reasonably stable, although much depends on price since, according to one source, much of the seed is increasingly being used for appearance purposes and less for flavour. If the price of celery seed increases, then substitution of other seeds, of which mustard and dill are the most common, may take place.

Other markets

Celery for use as a vegetable, and for seed is cultivated in **France**, but on a small scale. Indian exports of celery seed to France have annually averaged 217 tonnes during the 1970s (see Table 17), but Indian supplies have been supplemented by imports from Egypt, China and from local supplies. This would suggest annual consumption of around 250 – 300 tonnes, although there is a problem insofar as the magnitude of re-exports is unknown. Moreover, as in the case of the USA, not all celery seed is used direct, some being steam-distilled to produce an essential oil. Celery leaf is used in much smaller quantities, mainly in soups and salads, and is obtained from East and West Germany and from Hungary.

The **Federal Republic of Germany** (West Germany) satisfies its demand for celery leaf, which has been estimated at about 400 – 500 tonnes per annum, mostly from domestic production and Eastern European imports. One major importer also obtained supplies from Taiwan. However, West Germany is totally dependent on imports for supplies of celery seed, the annual market for which is estimated at around 150 – 200 tonnes. Indian exports to West Germany averaged 66 tonnes in the 1970s, some of which was re-exported, and these supplies are supplemented by those from China and Hungary. Although the demand for celery salt is increasing, demand for the herb is not expected to increase quickly and one important dealer thought that the demand for celery seed may even be declining.

Celery is a very popular flavouring in the **Netherlands**, but most of the demand is satisfied by domestic production, with the exception of celery seed, which is imported from India, France and China. During the 1970s Indian exports of celery seed to the Netherlands have averaged 54 tonnes per annum and total consumption is estimated at around 75 – 100 tonnes per annum, nearly all of which is used by the food processing sector (see Table 2). Demand for celery herb and seed is growing, but no particular long-term supply problems are envisaged.

In several respects the **United Kingdom** market for celery is similar to that of the Netherlands, with demand for the vegetable and leaf being mainly satisfied by local supplies, whilst celery seed for condimental purposes is imported. The UK market for celery seed is around 200 tonnes per annum, with India being the major supply source. Consumption appears to be relatively stable.

Switzerland's consumption of celery is very small. One major spice packer reported that ground celery is being imported in two forms: firstly, a few tonnes of ground vegetable (celeriac) from West Germany, which are sold via wholesalers to canning factories for use as a preservative in canned meats and, secondly, 100 Kg of ground leaves. Some seed is also imported. All types of

celery are used mainly by the food industry, in soups and sauces, and very little is used by the housewife.

The **Belgian** market for celery seed is estimated at around 20 tonnes per annum, which is imported mainly from India and used in both the industrial and retail sectors. Dehydrated celery is also used in small quantities.

In **Japan** celery is mainly employed in curries and celery salt, whilst much smaller quantities of dehydrated celery are also used as a condiment. Consumption of celery seed is estimated at around 150 – 200 tonnes per annum, with demand rising only slowly.

PRICES

The fact that there are several types of celery products available means that no one price series can be viewed as a reliable guide to celery prices. Moreover, a feature of some celery products, particularly celery seed, is the occasional wide annual fluctuations in prices which reflect, in the main, changes in the level of Indian supplies. However, the entry into international trade of new celery seed producers, particularly China, may help to stabilise price fluctuations to some extent. Dehydrated celery is much more expensive than celery seed, usually two to three times the price. Despite wide annual fluctuations in the late 1960s and early 1970s, average celery seed prices have not increased at the same rate as the prices of other herbs. The average fob unit price of Indian celery seed exports remained fairly stable in the mid-1960s, then fluctuated widely in the late 1960s and early 1970s between $0.48 per Kg and $1.03 per Kg. Between 1971/72 and 1975/76 it stabilised somewhat and ranged between $0.55 and $0.76 (see Table 17). The average fob value of US imports, and also New York spot prices, have fluctuated more widely than Indian export prices although the trend has been similar with farily stable prices in the mid-1960s, substantial fluctuation around the turn of the decade and relative stability since 1971. The US fob import prices and New York spot prices (see Table 18) also reveal the substantial premium paid for French supplies, reflecting their superior quality. The US fob mid-West price of celery oleoresin was quoted as $13.75 per Kg in mid-1978.

PROSPECTS

The fact that a large proportion of the demand for celery flavour is satisfied by local production, combined with the fact that the consumption of celery seed is stable or only increasing slowly, makes it difficult to recommend that any potential new producer should enter the market for celery products. However, a new producer of celery seed capable of supplying a higher quality product than that currently available, particularly in relation to less extraneous matter, should be able to sell his product at prevailing prices. But future prospects for celery seed are very much dependent upon trends in Indian production and if, over the longer term, Indian production were to fall, a new producer would then be most welcome. However, this does not appear to be an imminent prospect.

Table 17

Celery seed: exports from India

		1964/65	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77 [a]
TOTAL	Tonnes	1 080.8	2 149.8	1 842.0	1 781.6	2 230.2	1 844.7	3 137.9	2 911.9	1 830.1	2 914.1	1 922.0	2 243.4	2 834.6
	$'000	385.0	812.9	671.9	682.7	1 074.8	1 891.0	2 693.6	1 658.5	998.2	1 750.9	1 463.2	1 369.6	1 624.6
	$/Kg	0.36	0.38	0.36	0.38	0.48	1.03	0.86	0.57	0.55	0.60	0.76	0.61	0.57
of which to:														
USA	Tonnes	787.9	1 604.0	1 271.5	1 309.9	1 642.0	1 263.7	2 046.6	2 079.3	1 186.3	1 567.0	1 286.9	1 713.3	...
	$'000	273.8	601.9	464.3	504.5	786.1	1 390.1	1 610.8	1 186.3	658.6	960.2	963.0	1 046.5	...
	$/Kg	0.35	0.38	0.37	0.39	0.48	1.10	0.79	0.57	0.56	0.61	0.75	0.61	...
France	Tonnes	49.4	141.7	227.3	81.4	106.3	117.6	315.3	206.7	128.1	422.2	123.4	104.6	...
	$'000	19.9	52.3	81.8	30.6	48.9	121.4	302.3	120.9	72.1	277.9	96.3	63.1	...
	$/Kg	0.40	0.37	0.36	0.38	0.46	1.03	0.96	0.58	0.56	0.66	0.78	0.60	...
UK	Tonnes	90.4	180.7	169.2	183.7	289.4	218.0	259.7	167.6	49.0	172.7	227.9	66.3	...
	$'000	31.1	69.6	64.8	66.6	142.2	144.5	272.1	88.3	25.1	94.4	179.9	39.0	...
	$/Kg	0.34	0.39	0.38	0.36	0.49	0.66	1.05	0.53	0.51	0.55	0.79	0.59	...
Federal Republic of Germany	Tonnes	25.6	60.4	54.3	27.8	61.8	63.5	117.7	120.6	43.6	52.0	12.4	46.8	...
	$'000	9.4	24.0	17.1	10.4	30.8	51.3	117.5	72.3	26.5	30.3	8.1	28.7	...
	$/Kg	0.37	0.40	0.31	0.37	0.50	0.81	1.00	0.60	0.61	0.58	0.65	0.61	...
Japan	Tonnes	6.5	17.1	16.2	10.8	11.1	13.0	54.5	16.0	38.9	79.2	29.7	59.9	...
	$'000	2.3	6.5	5.4	4.1	6.3	10.4	62.0	8.0	22.0	48.2	22.9	33.4	...
	$/Kg	0.35	0.38	0.33	0.38	0.57	0.80	1.14	0.50	0.57	0.61	0.77	0.56	...
Singapore	Tonnes	–	–	–	0.2	1.5	–	1.0	55.3	205.6	365.2	15.7	46.6	...
	$'000	–	–	–	0.1	0.6	–	0.6	41.7	109.3	199.5	8.7	23.4	...
	$/Kg	–	–	–	0.50	0.40	–	0.60	0.75	0.53	0.55	0.55	0.50	...
Netherlands	Tonnes	34.9	34.8	20.0	35.2	27.9	37.0	106.0	42.9	36.2	83.1	23.1	34.8	...
	$'000	14.4	14.2	6.2	13.2	12.9	22.8	74.0	19.2	8.7	35.6	18.2	23.4	...
	$/Kg	0.41	0.41	0.31	0.38	0.46	0.62	0.70	0.45	0.24	0.43	0.79	0.67	...
Belgium	Tonnes	3.7	2.0	4.0	5.1	2.0	14.4	24.0	7.7	7.0	8.0	19.9	–	...
	$'000	1.1	0.8	1.4	1.8	0.7	15.5	26.0	4.2	3.1	4.9	16.2	–	...
	$/Kg	0.30	0.40	0.35	0.35	0.35	1.08	1.08	0.55	0.44	0.61	0.81	–	...

Table 17—*continued*

Celery seed: exports from India

		1964/65	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77 [a]
Italy	Tonnes	8.5	12.7	10.6	13.4	4.0	5.0	23.2	14.6	14.4	11.1	15.3	8.7	...
	$'000	3.2	5.0	3.5	5.2	2.8	7.1	22.6	7.0	8.9	5.1	11.4	4.3	...
	$/Kg	0.38	0.39	0.33	0.39	0.70	1.42	0.97	0.48	0.62	0.46	0.75	0.49	...
Australia	Tonnes	14.6	14.3	10.8	9.4	7.0	10.5	26.1	19.8	18.7	23.1	12.1	9.1	...
	$'000	6.9	5.7	4.3	3.8	3.9	12.4	27.9	10.9	8.4	15.6	10.7	5.5	...
	$/Kg	0.47	0.40	0.40	0.40	0.56	1.18	1.07	0.55	0.45	0.68	0.88	0.60	...
Canada	Tonnes	47.0	71.8	39.2	101.5	73.9	91.4	144.4	131.6	77.2	114.9	135.9	131.7	...
	$'000	17.4	29.1	17.5	41.3	38.2	108.3	156.7	71.1	43.1	70.4	114.4	88.3	...
	$/Kg	0.37	0.41	0.45	0.41	0.52	1.18	1.09	0.54	0.56	0.61	0.84	0.67	...
Sweden	Tonnes	—	—	1.0	—	1.0	—	2.1	3.0	2.0	—	3.1	2.0	...
	$'000	—	—	0.4	—	0.5	—	1.7	1.7	1.2	—	2.6	1.3	...
	$/Kg	—	—	0.40	—	0.50	—	0.81	0.57	0.60	—	0.84	0.65	...
Other countries	Tonnes	12.3	10.3	17.9	3.2	2.3	10.6	17.3	46.8	23.1	15.6	16.6	19.6	...
	$'000	5.5	3.8	5.2	1.1	0.9	7.2	19.4	26.9	11.2	8.8	10.8	12.7	...

Source: Monthly Statistics of the Foreign Trade of India: Exports and re-exports

Notes: (a) Preliminary
— nil or negligible
... not available

Table 18

Celery seed: imports into the USA and spot prices

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977 [b]	1978
TOTAL	Tonnes	953.2	1 597.2	1 236.2	1 413.3	1 719.3	1 345.3	1 822.4	1 907.2	1 684.2	1 515.2	2 105.7	1 946.2	1 467.5	1 901.8	...
	$'000 [a]	347.2	670.3	461.8	538.5	834.7	1 086.2	2 787.6	1 188.3	1 046.5	876.6	1 464.1	1 272.0	843.4	1 679.3	...
	$/Kg	0.36	0.42	0.37	0.38	0.49	0.81	1.53	0.62	0.62	0.58	0.70	0.65	0.57	0.88	...
of which from:																
India	Tonnes	890.0	1 520.1	1 161.9	1 288.6	1 608.7	1 267.4	1 705.7	1 756.3	1 634.0	1 455.5	1 851.3	1 681.2	1 423.4	1 836.6	...
	$'000	292.7	604.0	400.3	452.8	748.2	986.7	2 526.4	1 046.4	999.4	828.1	1 271.1	1 098.1	800.2	1 615.0	...
	$/Kg	0.33	0.40	0.34	0.35	0.47	0.78	1.48	0.60	0.61	0.57	0.69	0.65	0.56	0.88	...
France	Tonnes	63.2	77.1	74.3	94.2	85.1	77.9	94.2	150.9	50.2	51.7	110.6	74.6	25.1	18.3	...
	$'000	54.6	66.3	61.5	73.7	74.8	99.5	232.8	141.9	46.3	43.3	89.6	49.7	19.4	27.4	...
	$/Kg	0.86	0.86	0.83	0.78	0.88	1.28	2.47	0.94	0.92	0.84	0.81	0.67	0.77	1.50	...
China	Tonnes	–	–	–	–	–	–	–	–	–	–	62.0	184.8	16.1	25.0	...
	$'000	–	–	–	–	–	–	–	–	–	–	39.4	119.3	11.9	14.7	...
	$/Kg	–	–	–	–	–	–	–	–	–	–	0.64	0.65	0.74	0.59	...
Indonesia	Tonnes	–	–	–	30.5	25.4	–	–	–	–	–	–	–	–	–	...
	$'000	–	–	–	12.0	11.7	–	–	–	–	–	–	–	–	–	...
	$/Kg	–	–	–	0.39	0.46	–	–	–	–	–	–	–	–	–	...
Singapore	Tonnes	–	–	–	–	–	–	–	–	–	8.0	81.2	–	–	–	...
	$'000	–	–	–	–	–	–	–	–	–	5.2	61.5	–	–	–	...
	$/Kg	–	–	–	–	–	–	–	–	–	0.65	0.76	–	–	–	...
Taiwan	Tonnes	–	–	–	–	–	–	–	–	–	–	–	–	–	15.0	...
	$'000	–	–	–	–	–	–	–	–	–	–	–	–	–	8.1	...
	$/Kg	–	–	–	–	–	–	–	–	–	–	–	–	–	0.54	...
Pakistan	Tonnes	–	–	–	–	–	–	15.0	–	–	–	–	–	–	–	...
	$'000	–	–	–	–	–	–	10.8	–	–	–	–	–	–	–	...
	$/Kg	–	–	–	–	–	–	0.72	–	–	–	–	–	–	–	...
Other countries	Tonnes	–	–	–	–	–	–	7.4	–	–	–	0.6	5.6	2.9	6.9	...
	$'000	–	–	–	–	–	–	17.6	–	0.8	–	2.5	4.9	11.9	14.1	...
Approximate New York spot prices as of early March ($/Kg)																
French		...	...	...	...	...	...	6.06	1.79	1.01	0.97	1.17	1.06	1.15	...	...
Indian		...	...	...	...	...	...	4.96	0.82	0.86	0.79	0.93	0.97	0.75	1.04	1.06

Source: USDA Foreign Agriculture Circulars, Tea and Spices, various issues

Notes: (a) Market value in country of origin, exclusive of import duty (if any), freight and insurance charges
(b) Preliminary
– nil or negligible
... not available

Chapter 7

Chervil

INTRODUCTION

Chervil (*Anthruscus cerefolium*) is one of the minor culinary herbs. It is a small, low growing annual of the Umbelliferae family, resembling parsley, but sweeter and more aromatic. The leaves are light green, soft and fernlike, and the flowers are very small and white. Propagation is by seed, which is easily germinated and can be sown throughout the year. Chervil prefers a light, well drained, moderately rich soil, and shade or part-shade, preferably provided by taller plants. Harvesting takes place about 90 days after sowing, the outside leaves being picked first. Frequent harvesting encourages leaf growth and discourages flowering. In France and the USA the leaves are dehydrated by circulation of warm air, then fragmented by mechanical means and packed in plastic-lined containers, usually weighing 12.5 Kg. Chervil has an anise-like (some say tarragon-like) fragrance with a hint of pepper in its flavour.

There are several other plants which are sometimes called chervil, including the 'bulbous-rooted chervil' (*Chaerophyllum bulbosum*), which is a vegetable of a different genus of the parsley family (Stobart, 1970).

USES AND QUALITIES

The delicate flavour of chervil is similar to that of wild parsley. Its leaves are used mainly in flavouring sauces, stews and salads. It is one of the classic herbs in ravigote sauces. Chervil is a great favourite in French cuisine, where it is used as an alternative to parsley in soups and salads, particularly potato salads, and in 'fines herbes' combinations. It is a flavour catalyst amongst other herbs, that is, it adds to the flavour of other herbs whilst maintaining its own distinctive flavour. Hence it is used in 'bouquet garni' and 'fines herbes', and frequently in combination with tarragon. Chervil is also used to flavour white wine vinegar and salad dressings. The chervil herb faces negligible competition from its essential oil or its oleoresin, the commercial production of which is insignificant in both cases.

Chervil is sold in the whole form, and there are no flowering tops in the commercial product. According to one source the product is available in both air-dried and freeze-dried forms, but the latter is very expensive. The quality characteristics are measured by total and acid insoluble ash and freedom from stems.

PRODUCTION AND TRADE

The production and trade in chervil is extremely small in comparison with major culinary herbs and no statistics are available. Chervil is indigenous to southern Russia, the Caucasus and the Middle East, but it grows in many countries of the temperate zone and can be grown at higher elevations in the tropics. However,

France appears to dominate the small quantity of commercial production and the French product is exported to all parts of Europe. Small quantities are also produced commercially in southern Germany. This relatively small European production was badly affected by the 1976 drought. Some commercial production is reputed to take place in the Sacramento Valley, California, but knowledgeable sources agree that little chervil is grown in the USA.

MARKETS

The major markets for chervil are in Europe, with **France** the major consumer, nearly all of her supplies being domestically produced. One source estimated that 30 – 40 tonnes of dehydrated chervil are consumed each year, mainly in the north of France, where production is concentrated. Another source, however, suggested that India supplies small quantities to the French market. **The Federal Republic of Germany** (West Germany) is probably the second largest market in Europe, with estimates of consumption ranging from 5 to 20 tonnes per annum, most estimates being closer to the latter figure. All the major processors obtain their supplies from southern Germany, but the drought in 1976 created severe supply difficulties which resulted in price increases. The **Netherlands** is also supplied from domestic production along with imports from France, but the latter are very small as the market for the dried herb is less than 10 tonnes per annum. According to one source, consumption of the fresh herb is greater than that of the dried product, with the household sector being the major outlet. Other European markets, including Belgium, Switzerland and the UK, consume negligible quantities, whilst in Japan the major companies had heard of the product but knew of no consumption in their country. In the **USA** one source suggested that consumption of chervil was growing very rapidly, but nevertheless it was still used in very small quantities, perhaps 5 – 15 tonnes per annum. One processing company grows its own, but the majority of chervil is imported, mainly from France. Most major companies never or very rarely handle the product.

PRICES

Dehydrated chervil is quite an expensive herb. One French dealer quoted a price of 30 – 35 FF per Kg, whilst in West Germany the price is usually around 10.00 DM per Kg, but the drought of 1976 led to a doubling of the price. The Dutch price quoted was 15 – 25 guilders per Kg, depending on quality.

PROSPECTS

Whilst the price of chervil is relatively high compared with other herbs, the small quantities of the dried herb consumed make it difficult to recommend that a new producer should enter production. All the major European herb traders contacted appeared satisfied with existing suppliers, and did not feel that any new producer was needed, unless on a very small scale as an insurance against possible supply difficulties arising from climatic conditions. To enter the market solely with this aim cannot be recommended.

Chapter 8

Dill

INTRODUCTION

Dill is available commercially in the form of dill leaves (also called dill weed or dill herb) and dill seeds (which are the physically macerated dried fruits). Since the whole plant is aromatic the leafy tops and unripe fruits are used as a source of dill herb oil (also known as dill weed oil), whilst the ripe fruits are steam distilled to produce dill seed oil.

Dill is a member of the Umbelliferae, or parsley family, but the genus *Anethum* has two species: *Anethum graveolens*, which is the cultivated dill, sometimes known as American or European dill, and *A. sowa*, which is the Indian or Japanese dill. It is mainly the fruits of the Indian dill that enter international trade, and these seeds are of a shape slightly different from that of European dill. The seeds are flat, oval, usually 2 – 5 mm long, tan coloured, and usually split into two separate mericarps. Dill has a pleasant aromatic odour and flavour, reminiscent of caraway, but European dill seed differs somewhat in its physical properties, odour and flavour from Indian dill seed, the latter having a higher dillapiole content but a lower carvone content.

Dill is an annual and is relatively easy to grow, needing little attention. It grows to 60 – 90 cm in height, with alternate ferny, very finely divided light-green leaves and a stout stem with small dull yellow flowers. Propagation is by seeds which germinate promptly, and the best growing conditions are a well-drained sandy soil with full exposure to sunlight. In order to obtain the best dill herb, either for use as a herb or as the source of an essential oil, the plant should be harvested before it flowers, but to produce dill seed the fruits should only be harvested after they have reached maturity. Shattering of the seed during harvesting is a frequent occurrence, but this can be minimised by harvesting the seeds when they are damp with dew, that is, in the early morning or late evening.

USES AND QUALITIES

The major use of dill weed and dill seed is in food flavouring and seasoning. The fresh herb is widely used for these purposes in Asia, and on occasions it can be bought in European and American markets. Perhaps the best known use of dill is in the pickling of cucumbers, and in the USA this has become so closely identified with dill flavouring that they are known as dill pickles. Dill is also used in Europe, especially in Scandinavia, in the pickling industry, whilst other flavouring applications include soups, meat, fish, salads, confectionery, sauces, and cattle-feed. Dill is also used as a constituent of some curry powders, as well as being macerated in vinegar to produce dill vinegar.

The flavour of dill seed is substantially different from that of dill weed and therefore most people will not substitute one for the other. Dill weed is regarded by many as having a much better flavour than dill seed. Despite the differing charac-

teristics of European dill seed and Indian dill seed no one in the trade differentiated between their uses. This is probably because only relatively small quantities of European dill seed enter international trade. A large proportion of dill weed and European dill seed production is used in the producing country, either for the production of dill weed and dill seed oils or as herbs in flavouring, and therefore it is mainly Indian dill seed that enters international trade. Both dill seed and dill weed are sold mainly in the whole form, unless of course they are steam distilled into their respective essential oils. Some Indian dill seed also enters international trade as a constituent of curry powder.

Nowadays, dill is not widely used for medicinal purposes, its most common use being in the preparation of dill water or syrup for babies. Dill seed oil is used in soap and perfumery whilst dill weed oil is mainly used for flavouring and seasoning purposes in the food industry. In this latter usage dill weed oil has largely replaced both the whole herb and dill seed oil. From dill seed other derivatives are produced, including an oleoresin, infusion, tincture and fluid extract, but these appear to be of limited commercial importance.

PRODUCTION AND TRADE

Although dill's origins are variously given as the Orient and southern Europe, production is now geographically widespread. Dill grows wild on all continents, and is cultivated in most European countries, including Romania, Hungary, Poland, West Germany, Denmark, Holland, Austria, Spain, Italy, and in the USA, Canada, Mexico, India, the USSR, Japan and Kenya. There is very little or no information on levels of production and trade for most countries.

The only export statistics available deal with Indian dill seed (*A. sowa*) but these cannot be used as a measure of production because of the large level of domestic consumption of dill in the various forms. India is almost certainly the major producer of dill seeds, also known as 'sowa', and in the late 1950s it was estimated that about 1 350 tonnes of sowa fruits were produced each year, of which approximately one-third was exported. If a similar ratio between production and exports exists today, then average Indian exports of around 900 tonnes for the period 1972/3 – 1975/6 would suggest Indian dill seed production of between 2 500 and 3 000 tonnes per annum.

Commercial production of dill (*A. graveolens*) is undertaken in the USA but most of the dill output is steam-distilled into dill weed oil. Production began around 1930 in response to the demands of the pickle and kraut manufacturers, with Ohio, Indiana and Michigan becoming the principle centres of production. Later production shifted to Oregon, Washington, Idaho and California, and in the last-mentioned state there are today four main producers. Some produce dill weed for the fresh market, but this market is much smaller than that for the dried product. In California dill weed is grown together with basil, since they have different harvesting periods. Dill is harvested in April – May and basil in June – July, and this permits fuller utilisation of drying equipment. The American demand for dill weed was for a long time entirely satisfied by domestic production, although in recent years demand has begun to outstrip supply, despite increased levels of production. The situation has become somewhat complicated because there is demand in Europe for American grown dill although it is twice the price of European grown dill. This is because of the quality of American dill which, according to some sources, has more flavour and a brighter green colour than the European produced dill herb. Packing and industrial concerns in Europe, including fish packers in Scandinavia, have increased their demands, and one source has estimated that approximately 20 per cent of US dill weed production is exported.

Almost all US consumption of dill seed is imported and, despite some wide annual fluctuations, the trend of imports during the 1960s and 1970s was upwards, reaching a peak of nearly 800 tonnes in 1973 (see Table 20). Since 1974

imports have shown a downward trend, averaging 536 tonnes for the period 1974 – 77. India has been the USA's dominant source of supply of dill seed, in some years supplying 100 per cent of US imports, and in fact in the 1970s India has supplied an average of 97 per cent of US requirements. Other countries that have exported dill seed to the USA include China, Indonesia, Pakistan, Nepal, Mexico, Canada, West Germany, the Netherlands, Hungary, Sweden, France, Denmark and Yugoslavia, but in no year have the combined imports from these sources exceeded 10 per cent of total US imports. In several cases it is more than likely that exports to the USA are in fact re-exports of supplies originally from India.

As might be expected, the trend of Indian exports of dill seed has been similar to that of US dill seed imports, the USA taking about 70 per cent of Indian exports in recent years. Other countries taking relatively sizable imports of Indian dill seed including Japan, whose imports in the decade 1966/67 – 1975/76 averaged almost 50 tonnes per annum. Other countries that have recently imported over 30 tonnes in any one year include Canada, the UK, West Germany, Singapore and the Netherlands. (See Table 19.)

MARKETS

The United States of America

The USA is a major market for both dill weed and dill seed. Dill weed is a very popular herb, but nearly all the US market is satisfied by domestic production, and one spice packing company that grows its own dill weed supplies about 25 per cent of the dill herb market. Demand for dill weed is rising very rapidly and it has been suggested that so far demand has outstripped production, with the consequent price rise. Nevertheless most producers are raising production levels, and it is possible that some of the USA's dill weed exports to Europe could easily be switched to the domestic market.

Other markets

The trade statistics of **France** do not specify dill imports, but dill seed is certainly consumed, mainly in the baking industry, either whole or in the form of a concentrate on a powder base for flavouring pastries. Both the whole and ground forms of dill seed are sold at the retail level. In **West Germany** dill herb is very popular, and most estimates suggested that consumption was around 200 tonnes a year. All sources agreed that demand was increasing rapidly, the major sources of supply being domestically produced dill from southern Germany, along with Hungary and Egypt. The market for dill seed is much smaller, the use being mainly with cucumber. India was cited as the only source of supply, and annual consumption was estimated at around 30 tonnes. Consumption of dill seed is also very small in the **Netherlands**, estimates suggesting only a few tonnes, with supplies being obtained from India and China. Dill herb consumption is estimated at 5 – 10 tonnes, with France cited as the major supplier. The Scandinavian countries are often cited as important users of dill herb, but unfortunately no data are available on market size. In **Belgium**, the **United Kingdom, Switzerland** and **Japan**, dill is not a popular herb, and consumption has been estimated to be less than 5 tonnes per annum in each country. In Japan, however, dill seed is more widely used, with annual consumption estimated at around 50 tonnes.

PRICES

The available data on dill prices consist of the average fob price of Indian dill seed exports and US dill seed imports, together with New York and London spot prices of Indian dill. As Table 19 shows, the average value of Indian dill seed exports was fairly stable during the late 1960s, averaging $0.23 per Kg during the period 1964/65 – 1968/69. From 1969/70 onwards unit values were subject to much wider annual fluctuations, with peaks of $0.41 per Kg in 1969/70 and 1973/74,

but with an annual average of $0.34 per Kg during the period 1970/71 – 1975/76. As one would expect, US import prices have shown a similar trend, with a slight rise during the late 1960s, reaching a peak of $0.44 per Kg in 1970. During the 1970s US import and spot prices have shown wider fluctuations, with unit values showing an upward trend from a low of $0.27 per Kg in 1971 to $0.54 per Kg in 1977 (see Table 20).

As with most herbs and spices, it appears that changes in production, as a result of climatic factors and prices received in previous years, have been major factors influencing price trends. The fluctuations in dill seed prices have been smaller than those for most other herbs, partly because dill's hardiness makes it less subject to production fluctuations due to climatic factors. Moreover, since India exports less than half her total production and several countries satisfy much of their demand for dill from domestic production, it is likely that when prices do increase production meant for domestic use will be diverted onto the international market, thus reducing price variations.

Whilst the future price of dill seed is likely to remain below $0.50 per Kg, it is likely that the price of dill leaves will increase with rising production costs, since the seed and leaves are often produced separately in terms of geographical origin.

PROSPECTS

Currently the production of dill weed is a more attractive proposition than that of dill seed, provided a herb of satisfactory flavour and colour can be produced. However, a new producer will face intense competition from US producers, especially in the American market, and from European producers, particularly if the price of dill herb continues to increase and existing producers expand output. Future consumption will be very much dependent on the growth trends of those products in which dill is incorporated, especially in the pickle industry. From the trade data in Tables 19 and 20 the trend of demand for dill seed appears to be upward, with only a temporary easing back being apparent in 1974 and 1975. Prospects for a new producer of dill seed are very much dependent upon the future trend of Indian supplies.

Table 19

Dill seed: exports from India

		1964/65	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76
TOTAL	Tonnes	519.0	458.3	525.3	336.3	554.0	390.6	521.1	741.5	1 159.0	864.2	775.8	865.7
	$'000	102.7	100.8	124.3	82.5	123.2	160.1	183.5	200.2	378.0	351.6	264.2	259.1
	$/Kg	0.20	0.22	0.24	0.25	0.22	0.41	0.35	0.27	0.33	0.41	0.34	0.30
of which to:													
Canada	Tonnes	8.0	12.2	20.3	4.0	15.5	14.5	–	30.0	–	35.2	14.7	36.5
	$'000	1.8	3.1	5.4	1.2	4.6	6.1	–	9.4	–	17.0	8.0	13.0
	$/Kg	0.23	0.25	0.27	0.30	0.30	0.42	–	0.31	–	0.48	0.54	0.36
Sri Lanka	Tonnes	10.0	9.3	10.7	8.8	66.5	9.0	–	–	–	–	3.4	3.8
	$'000	1.6	1.8	1.9	1.7	11.4	3.4	–	–	–	–	1.2	1.1
	$/Kg	0.16	0.19	0.18	0.19	0.17	0.38	–	–	–	–	0.35	0.29
Japan	Tonnes	59.0	77.9	22.7	44.5	30.0	38.0	87.7	48.3	45.7	66.0	40.0	69.5
	$'000	11.9	18.0	4.4	9.4	6.7	15.5	31.2	10.3	11.8	21.7	12.6	16.6
	$/Kg	0.20	0.23	0.19	0.21	0.22	0.41	0.36	0.21	0.26	0.33	0.32	0.24
Kenya	Tonnes	23.0	26.0	31.3	17.2	23.7	12.4	22.6	–	–	–	10.8	13.6
	$'000	6.3	5.8	7.3	4.2	6.7	4.9	8.4	–	–	–	4.8	5.0
	$/Kg	0.27	0.22	0.23	0.24	0.28	0.40	0.37	–	–	–	0.44	0.37
UK	Tonnes	60.0	20.0	24.0	24.0	15.2	6.0	–	66.6	70.6	74.0	21.9	80.7
	$'000	10.6	4.0	5.8	5.2	3.3	1.8	–	15.7	19.0	26.2	7.4	23.2
	$/Kg	0.18	0.20	0.24	0.22	0.22	0.30	–	0.24	0.27	0.35	0.34	0.29
USA	Tonnes	171.0	197.9	294.6	164.4	316.7	262.3	272.1	455.9	882.4	478.0	576.3	511.8
	$'000	33.9	45.3	75.4	45.4	72.0	109.7	99.6	130.0	303.9	203.4	192.1	159.8
	$/Kg	0.20	0.23	0.26	0.28	0.23	0.42	0.37	0.29	0.34	0.43	0.33	0.31
Ethiopia	Tonnes	42.0	1.1	34.3	16.0	19.0	–	–	–	–	–	29.8	15.0
	$'000	6.9	0.3	6.2	3.2	3.8	–	–	–	–	–	9.8	3.8
	$/Kg	0.16	0.27	0.18	0.20	0.20	–	–	–	–	–	0.33	0.25
Federal Republic of Germany	Tonnes	67.0	77.5	44.4	8.9	20.6	–	–	–	–	–	28.0	40.5
	$'000	16.3	14.9	9.3	1.8	4.2	–	–	–	–	–	10.1	10.6
	$/Kg	0.24	0.19	0.21	0.20	0.20	–	–	–	–	–	0.36	0.26
Singapore	Tonnes	31.0	–	11.7	24.3	17.4	23.6	27.6	–	35.3	–	12.2	34.4
	$'000	4.7	–	2.3	4.9	3.9	7.8	8.5	–	10.2	–	3.6	8.8
	$/Kg	0.15	–	0.20	0.20	0.22	0.33	0.31	–	0.29	–	0.30	0.26
Netherlands	Tonnes	–	5.1	–	1.5	2.5	–	–	–	31.6	57.2	2.0	27.4
	$'000	–	1.1	–	0.3	0.6	–	–	–	6.6	29.2	0.7	7.6
	$/Kg	–	0.22	–	0.20	0.24	–	–	–	0.21	0.51	0.35	0.28
Other countries	Tonnes	48.0	31.3	31.3	22.7	26.9	24.8	111.1	140.7	93.4	153.8	36.7	32.5
	$'000	8.7	6.5	6.3	5.2	6.0	10.9	35.8	34.8	26.5	54.1	13.9	9.6

Source: Monthly Statistics of the Foreign Trade of India – Exports and re-exports

Note: – nil or negligible

Table 20

Dill seed: imports into the USA and spot prices

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977[b]	1978
TOTAL	Tonnes	213.2	264.7	307.1	230.6	322.5	197.5	314.7	401.2	627.8	797.7	604.4	501.3	623.0	414.2	...
	$'000[a]	45.4	66.1	85.9	69.0	84.0	71.8	139.1	108.8	183.9	306.7	273.0	183.0	199.9	224.4	...
	$/Kg	0.21	0.25	0.28	0.30	0.26	0.36	0.44	0.27	0.29	0.38	0.45	0.37	0.32	0.54	...
Of which from:																
India	Tonnes	195.2	264.7	247.3	173.7	322.0	177.4	302.8	364.9	624.9	757.0	602.8	486.4	605.8	408.2	...
	$'000	36.3	66.1	58.3	42.0	83.6	66.3	127.8	102.6	179.0	289.3	271.2	148.9	183.4	209.3	...
	$/Kg	0.19	0.25	0.24	0.24	0.26	0.37	0.42	0.28	0.29	0.38	0.45	0.31	0.30	0.51	...
Netherlands	Tonnes	1.0	–	0.5	–	0.5	–	–	–	–	0.5	1.4	1.4	0.9	–	...
	$'000	0.7	–	0.3	–	0.4	–	–	–	–	0.5	1.5	2.7	1.4	–	...
	$/Kg	0.70	–	0.60	–	0.80	–	–	–	–	1.00	1.07	1.93	1.56	–	...
Mexico	Tonnes	16.3	–	49.0	56.9	–	–	1.5	–	–	4.4	–	–	–	–	...
	$'000	7.9	–	24.9	27.0	–	–	0.8	–	–	2.6	–	–	–	–	...
	$/Kg	0.48	–	0.51	0.47	–	–	0.53	–	–	0.59	–	–	–	–	...
Federal Republic of Germany	Tonnes	0.5	–	0.1	–	–	–	4.6	–	–	–	–	7.5	0.5	1.0	...
	$'000	0.4	–	0.3	–	–	–	7.8	–	–	–	–	27.3	1.9	4.1	...
	$/Kg	0.80	–	3.00	–	–	–	1.70	–	–	–	–	3.64	3.80	4.10	...
Indonesia	Tonnes	–	–	–	–	–	–	–	–	–	–	–	–	15.1	–	...
	$'000	–	–	–	–	–	–	–	–	–	–	–	–	5.4	–	...
	$/Kg	–	–	–	–	–	–	–	–	–	–	–	–	0.36	–	...
Egypt	Tonnes	–	–	–	–	–	–	–	–	–	–	–	–	–	5.0	...
	$'000	–	–	–	–	–	–	–	–	–	–	–	–	–	11.0	...
	$/Kg	–	–	–	–	–	–	–	–	–	–	–	–	–	2.20	...
Other countries	Tonnes	0.2	–	10.2	–	–	21.1	5.8	36.3	2.9	35.8	0.2	6.0	0.7	–	...
	$'000	0.1	–	2.1	–	–	5.5	2.7	6.2	4.9	14.3	0.3	4.1	7.8	–	...
Approximate New York spot prices as of early March ($/Kg) Indian		...	...	...	...	...	...	0.75	0.60	0.55	0.68	0.75	0.62	0.55	0.62	1.23

Source: USDA Foreign Agriculture Circular, Tea and Spices, various issues.

Notes: (a) Market value in country of origin, exclusive of import duty (if any), freight and insurance charges
(b) Preliminary
– nil or negligible
... not available

Chapter 9

Marjoram

INTRODUCTION

In any discussion of marjoram one is dealing with a most confused area of botanical nomenclature, and despite many efforts there is still some confusion and mislabelling in the trade. The vernacular term 'marjoram' comprises several aromatic plants belonging to related or separate species, and to obtain any understanding one must also discuss the herbs oregano (also known as wild marjoram or origan) and thyme, and these are dealt with separately in Chapters 11 and 17 respectively.

Formerly oregano and marjoram were considered a single species (*Origanum marjorana*), but marjoram has now been separately identified as *Marjorana hortensis*), whilst the mild type of oregano is from one of several species of *Origanum*, mainly that of *Origanum vulgare*. The Spanish wild marjoram is of quite a different character and is obtained from *Thymus mastichina* and other *Thymus* species.

Sweet or knotted marjoram (M. hortensis) is a low, tender, bushy perennial, growing 30 – 60 cm high and characterised by the many tiny 'knots' which it produces. It has downy, narrow, light green to light grey-green leaves about 13 mm long, with hairs on either side; the flowers are white or pinkish. Propagation is by seeds or cuttings, and it is relatively easy to grow, given a good light soil and preferably plenty of sun. Unlike most of the labiate herbs, sweet marjoram (like basil) is sweeter when it is not grown under difficult conditions. It is grown as an annual in northern climates, but in warm climates it is a perennial, and two harvests per annum are possible. The plants should be harvested by cutting when mature, dried in a well-ventilated room, and the leaves separated from the stems by stripping or flailing when completely dry. Sweet marjoram has a delicate, pleasant, sweet flavour, compared with oregano which is stronger, lustier and more piquant. The flavour of sweet marjoram is related to that of thyme, which it often replaces, but marjoram is more sweet and scented.

French marjoram (*Origanum onites*) is hardier and easier to grow than sweet marjoram, but it is less sweet and more bitter. It is a perennial, growing to about 30 cm high, and preferring a good light soil and sun. Propagation is by seed or root diversion. In Greece, pot marjoram grows wild and is one of several plants called 'rigani', all of which are wild species of *Origanum*, including *O. paniflorum, O. smyrnaicum, O. heraclesticum* (winter marjoram)(Stobart, 1970). Another species of *Origanum* is commonly known as Cretan dittany, which, as its name suggests, is mainly cultivated in Crete. The latter plant is a perennial with 'cottony' leaves and small pink flowers, and is occasionally known as 'Hop plant'.

Much of the confusion in commerce regarding marjoram, oregano, and thyme is caused by the fact that the essential oils from these various plants are often blended and offered under a variety of related names. It is now generally agreed that the sweet marjoram oil is steam distilled from *Majorana hortensis*, whilst

what is known in commerce as 'oil of wild marjoram' is distilled from *Thymus mastichina*. Origanum oil is obtained from *Thymus capitatus* and several species of *Origanum*, whilst 'thyme oils' may also be derived from several *Thymus* species.

USES AND QUALITIES

Marjoram is one of the most important kitchen herbs, having a wide range of uses. Sweet marjoram is the most commonly used variety, pot marjoram not being used a great deal for flavouring purposes. Marjoram is used particularly in European cooking for flavouring vegetables, cheese, soups, sauces and meats, the last mentioned including liverwurst, salami and bologna, and for chicken and turkey stuffings. Fresh marjoram is also used as a seasoning for salads. As we have already seen marjoram has a flavour similar to that of thyme, and it can be added to practically any dish in which thyme is used. For example, both are employed in the customary bouquet of herbs for flavouring soups and stews. The dried herb also faces competition from the oleoresin, some food manufacturers using marjoram oleoresin in the production of liverwurst, bologna and cheese.

Marjoram has some medicinal uses, whilst both the dried product and a tincture are used in production of vermouths and bitters. The essential oil is employed to formulate compounded oils for flavouring sauces, condiments, canned meats and other products. Marjoram seed has also been used as a flavouring.

Cretan dittany is used mainly for medicinal purposes, but also as a food flavouring and an ingredient of vermouth, whilst other species (collectively known as 'rigani') are used with grilled meats and other Greek dishes. However, none of these herbs appears to be commercially available outside Greece.

Marjoram is used in both the fresh and dried forms, some arguing that it is more pungent when dried. In the dried form, with or without a small proportion of the flowering tops, it is available both whole and ground. The smaller leaves are usually whole, the larger leaves always broken. Marjoram should not contain more than 10 per cent of stems by weight, and quality characteristics are measured by the volatile oil, total and acid insoluble ash, starch and moisture contents.

PRODUCTION AND TRADE

Marjoram is indigenous to the area extending from Libya and Egypt through Arabia to India. South-western Africa is sometimes given as the only place of origin, but it has now become established in the Mediterranean region and Europe, where it has been cultivated for many centuries. It is also found growing wild in several areas, including Central Europe. The dried herb is produced in France, East and West Germany, Hungary, Poland, Czechoslovakia, and Romania. It is also grown to a lesser extent in Italy, Spain, Cyprus, Tunisia, Portugal, the Lebanon, Mexico, the USA, Chile, Peru, Argentina and the Dominican Republic, as well as in parts of Asia.

The only official statistics available are of US imports, and even these may be inaccurate to the extent that oregano is sometimes sold as marjoram, and vice versa. A major US processor suggested that less than 20 per cent of French marjoram exports were truly French and that of the other 80 per cent, half was a mixture of oregano and marjoram. It was also suggested that many in the trade could not distinguish between true marjoram and the variety of mixtures available.

In the 1960s a high proportion of US supplies came from Mexico, which would suggest that they were mainly oregano rather than marjoram. During the 1970s Mexico has supplied no marjoram to the USA. (See Table 21.) Official US imports of marjoram have fluctuated widely since 1964, with a peak of 672 tonnes

in 1966, of which nearly 70 per cent came from Mexico, and a low of 162 tonnes in 1969. Average annual imports during the decade 1968–77 were 294 tonnes. No discernible trend is apparent, imports being at a high level 1964–68, but much lower in 1969, followed by a period of relative stability in the early 1970s, and wide fluctuations during the period 1974–77. Until recently France has been the USA's major supplier, usually accounting for well over 50 per cent. The Lebanon was also an important source, particularly in the early 1970s, but since then imports from this source have declined to nothing, probably as a result of internal political problems. Although supplying only negligible quantities in the late 1960s Egypt had become the major supplier by 1976, exports to the USA increasing from 5 tonnes in 1970 to 236 tonnes in 1977. The drought in Europe in 1976 was probably a major factor facilitating Egypt's rise to predominance, but several sources suggested that Egypt was now exporting her production direct, rather than through France as previously. One major US broker pointed out that only a small proportion of US imports from France were of truly French origin, the rest more probably being re-exports from Egypt and the Lebanon, the Lebanon's exports in turn originating in part from Syria. He also estimated that current Egyptian production was at least 750 tonnes per annum, of which approximately 400 tonnes were shipped to Europe. A new major supplier to the US market could be Chile, which in 1977 supplied nearly 15 per cent of US imports. Several other countries have also supplied the USA with small quantities, including the Dominican Republic, Greece, Peru, Poland, Mexico, the Netherlands, Yugoslavia, Portugal, Spain, Syria, Canada, Bulgaria and Argentina.

Marjoram is occasionally adulterated with other dried leaves, particularly those of *Citrus* spp., as well as a species of lime (*Tilia argenta*) and a member of the family Malvaceae, *Althaea officinalis* (Brouk, 1975). A common commercial practice, which has helped to increase the confusion that exists between marjoram and oregano, is that oregano is marketed as 'marjoram' when the latter is in short supply, and vice versa. However, whilst the demand for oregano has grown rapidly in the past three decades, especially in the USA, there has been only a relatively small growth in the use of marjoram. However, this is the result of supply shortages rather than a failure of demand to increase. Every trade source with which marjoram was discussed expressed concern over the difficulties of obtaining satisfactory supplies.

MARKETS

The United States of America

Most marjoram used commercially in the USA is imported. Although some domestic commercial production is undertaken this accounts for less than 10 per cent of consumption. Consumption in the USA is approximately 300–400 tonnes per annum, and it is used mainly in the seasoning of French- and Italian-type foods and as an ingredient of mixed herbs.

Other markets

France is a larger market for marjoram than the USA, with estimated consumption in excess of 500 tonnes per annum. Egypt is now the main supplier to the French market, with local French producers in second place. Several of the other suppliers listed in the previous section also export to France, including Tunisia, which is considered the best supply source from the point of view of essential oil distillers, and Spain, whose marjoram was considered by one dealer not to be marjoram at all. Of the herbs under review marjoram is one of the most frequently cited regarding the difficulty in obtaining sufficient quantities.

Perhaps the largest market for marjoram is the **Federal Republic of Germany** (West Germany), where it is one of the most important herbs consumed. All estimates agree that German consumption is at least 500 tonnes per annum, and some suggested it might be closer to 1 000 tonnes. Some of this large market is supplied by local production, but most comes from Eastern Europe, especially

East Germany which produces the best quality, followed by Hungary. Smaller quantities are available from Poland, Romania, Bulgaria, Yugoslavia and France. In recent years Egypt has become a very important source of supply for the West German market. Marjoram is used in large quantities in the sausage and meat industry, whilst the pharmaceutical industry, household sector and liqueur industry consume significant quantities. Whilst demand for this traditional herb is thought to be increasing, the expansion in demand is not as significant as for other herbs.

In the **Netherlands** and the **United Kingdom** marjoram is less popular than in either West Germany or France. No domestic commercial production is undertaken in either country, and estimates of consumption are around 150 tonnes and 50 – 75 tonnes respectively. In both cases the major usage appears to be as an ingredient for mixed herbs. Whilst the Netherlands obtains most of its supplies from France and Eastern Europe, the major source for the UK is Egypt.

Consumption of marjoram in **Switzerland, Belgium** and **Japan** is not very large, estimates suggesting that consumption is between 10 and 20 tonnes in each market. **Czechoslovakia** is reported to be a large consumer of marjoram, but meets some 60 per cent of its requirements (100 – 150 tonnes) from domestic production.

PRICES

The price of marjoram has exhibited an upward trend in recent years, particularly in 1976 when severe supply shortages became apparent. The average fob price of US imports more than doubled from $0.57 per Kg in 1967 to $1.28 per Kg in 1977. French supplies have been priced higher than those from the Lebanon, Chile and Egypt, reflecting in part their higher quality (see Table 21). A similar situation exists on the French market, where French marjoram normally sells at 6.00 – 7.00 FF per Kg, Egyptian normally at 3.50 – 4.00 FF per Kg and Tunisian normally at 3.00 FF per Kg. The shortages of 1976, however, caused prices to increase to 15.00 FF per Kg, 10.00 – 12.00 FF per Kg and 7.50 FF per Kg respectively. Some sources suggested that East German (Türingen) and Hungarian marjoram were of even better quality than the French and thus commanded a higher price. In West Germany the normal price of marjoram is around 2.50 DM per Kg, but again prices rose as high as 8.00 – 10.00 DM per Kg in 1976.

PROSPECTS

Of all the herbs discussed in this report, marjoram was the one most frequently mentioned in the context of supply shortages. It would seem, therefore, that the market prospects for this herb are particularly good and that new producers would be most welcome. However, as with most herbs, a new producer should exercise caution in entering production. In the first place, the recommendations of the trade tend to be related to the current or short-term situation and their opinions regarding marjoram were very much influenced by the severe shortages created by the 1976 drought in Europe. Secondly, as shown in this chapter, there are many countries that have in the past produced marketable marjoram and if each of these expanded production simultaneously the effects on prices could be disastrous. The ability to expand production very quickly has already been illustrated by Egypt. Finally, no evidence has been seen which suggests that the demand for marjoram is increasing more rapidly than that for most herbs; in fact US statistics would suggest that growth has been relatively slower. Therefore, although the prospects for majoram appear good, any new producer should make a cautious entry into the market, particularly as prices are unlikely to remain at the high levels reached in 1976.

Marjoram*: Imports into the USA and spot prices

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977[a]	1978
TOTAL	Tonnes	320.2	393.3	672.2	372.9	379.7	162.1	276.9	252.2	223.3	293.6	393.2	239.9	310.2	407.9	...
	$'000[b]	199.0	231.0	315.0	214.3	221.6	143.4	262.0	208.3	154.5	243.2	411.0	229.3	336.1	521.3	
	$/Kg	0.62	0.59	0.47	0.57	0.58	0.88	0.95	0.83	0.69	0.83	1.05	0.96	1.08	1.28	
of which from:																
France	Tonnes	144.2	146.1	142.4	139.7	144.3	101.4	203.0	191.6	157.9	225.6	237.1	132.9	125.5	91.5	
	$'000	135.0	132.0	124.0	125.2	136.1	119.0	229.5	172.5	122.1	200.1	244.5	127.3	154.3	125.6	
	$/Kg	0.94	0.90	0.87	0.90	0.94	1.17	1.13	0.90	0.77	0.89	1.03	0.96	1.23	1.37	
Lebanon	Tonnes	...	...	...	2.0	32.2	28.0	58.2	46.9	51.3	35.8	20.1	25.3	2.8	–	
	$'000	...	...	...	1.0	12.6	12.2	23.6	23.2	19.9	16.0	11.8	14.2	2.7	–	
	$/Kg	...	...	...	0.50	0.39	0.44	0.41	0.49	0.39	0.45	0.59	0.56	0.96	–	
Egypt	Tonnes	...	...	...	1.5	–	–	5.0	9.4	10.0	15.0	73.0	56.9	161.4	236.3	
	$'000	...	...	...	1.6	–	–	0.6	9.5	8.5	12.6	66.9	49.9	150.9	300.2	
	$/Kg	...	...	...	1.07	–	–	0.12	1.01	0.85	0.84	0.92	0.88	0.93	1.27	
Dominican Republic	Tonnes	...	...	...	7.7	–	–	1.7	2.5	–	–	1.1	10.3	0.4	–	
	$'000	...	...	...	4.7	–	–	0.8	0.5	–	–	0.7	5.7	0.3	–	
	$/Kg	...	...	...	0.61	–	–	0.47	0.2	–	–	0.64	0.55	0.75	–	
Greece	Tonnes	...	...	...	–	–	–	–	–	4.1	10.0	17.0	14.1	0.1	14.6	
	$'000	...	...	...	–	–	–	–	–	3.3	7.5	42.5	29.0	0.3	20.5	
	$/Kg	...	...	...	–	–	–	–	–	0.80	0.75	2.50	2.06	3.00	1.40	
Chile	Tonnes	...	...	...	4.5	12.9	–	–	–	–	–	13.0	–	–	60.1	
	$'000	...	...	...	2.1	7.5	–	–	–	–	–	12.6	–	–	57.0	
	$/Kg	...	...	...	0.47	0.58	–	–	–	–	–	0.97	–	–	0.95	
Mexico	Tonnes	123.4	179.6	459.9	209.3	133.4	24.1	–	–	–	–	–	–	–	–	
	$'000	37.0	58.0	151.0	71.2	54.2	5.8	–	–	–	–	–	–	–	–	
	$/Kg	0.30	0.32	0.33	0.34	0.41	0.24	–	–	–	–	–	–	–	–	
Other countries	Tonnes	52.6	67.6	69.9	8.2	56.9	8.6	9.0	1.8	–	7.2	31.9	0.4	20.0	5.4	
	$'000	27.0	41.0	40.0	8.5	11.2	6.4	7.5	2.6	0.7	7.0	32.0	3.2	27.6	18.0	
Approximate New York spot prices as of early March ($/Kg) French		...	...	...	...	...	...	1.94	1.70	1.52	1.48	1.65	1.46	1.55 –1.75	1.76	2.03

Sources: USDA Foreign Agriculture Circular, Tea and Spices, various issues.
US Tariff Commission (1968)

Notes: * In 1968 the USA imported 15.3 tonnes of processed marjoram valued at $9 400 from Mexico and Poland. In 1971, 1973, 1974 and 1977 quantities of less than 1 tonne were imported from various sources, and in 1976 1.5 tonnes valued at $900 were imported from Syria and the Dominican Republic. These are not included

(a) Preliminary

(b) Market value in country of origin, exclusive of import duty (if any), freight and insurance charges

– nil or negligible

... not available

Chapter 10

Mint

INTRODUCTION

Mint is probably the world's most important flavour after vanilla and citrus, and the commercial cultivation of the plants known as peppermint (*Mentha piperita*) and spearmint (*M. spicata*) for use in flavouring constitutes an industry involving transactions worth many millions of pounds sterling each year. It is the essential oils estracted from the various members of the genus *Mentha* (Family Labiatae) that satisfy the vast proportion of the demand for mint flavouring, although mint leaves are still among the most important herbs.

Mint is a perennial herb and has a complicated botanical background, there being many hybrids of the *Mentha* species, but *M. piperita* and *M. spicata* are the two major varieties in the herb trade. Both varieties are indigenous to Europe and the Mediterranean region, but have become naturalised throughout much of the temperate world, both north and south of the equator. In the tropics spearmint will grow under partial shade even at low elevations, though it thrives best in temperate zones. Attempts to grow *M. piperita* in tropical countries have not been very successful because of the need for long daylight hours during the growing season. Although *M. arvensis* (Japanese mint or cornmint) is grown extensively in the tropics, it is used for the production of menthol and dementholised peppermint oil; the herb as such does not appear to enter international trade.

Because of the large number of varieties, and also because mint is productive for five to six years, it is necessary to ensure that suitable stock is used from the beginning. Propagation is by cuttings, and a rich moist soil is preferable, although mint can adapt itself to many conditions once growth is under way. In recent years some producers have faced a shortage of suitable disease-free root stock, especially of spearmint varieties, and disease continues to be a major problem in mint cultivation. *M. piperita* grows to between 30 – 90 cm tall, either with an erect green stalk and white flowers (the variety *officinalis* known as 'white mint') or with reddish-brown stalk and flowers (the *vulgaris* variety, known as 'black mint'). Today most of the world's production is of the latter type. Whilst *M. piperita* has a petioled (stalked) leaf, spearmint has a sessile (non-stalked) leaf which is less pungent in taste than the former. The taste and flavour of both types is fresh, strong, sweet and tangy, with a cool aftertaste, although the flavour varies according to the soil and climate in which the plant is grown. The harvesting of the leaves should take place just as flowering begins, although fresh leaves may be cut at any time. Occasionally more than one harvest per season can be undertaken, but this tends to weaken the plant and, according to some sources, the flavour is never as satisfactory in successive harvests.

USES AND QUALITIES

The aromatic leaves of peppermint and spearmint are widely used for either flavouring or medicinal purposes. In the form of mint sauce and mint jelly, they

are popular accompaniments for roast lamb in the UK and USA. As a condiment mint is a popular flavour in many sauces, desserts, salads, jellies, chilled fruits and vinegars, and on potatoes and peas. Spearmint is the variety most used for culinary purposes and is usually used in mint jelly and mint sauce. Peppermint is an exception among herbs in that it is rarely used in cooking, most people finding peppermint oil a more suitable flavouring agent.

Peppermint is the herb most widely used for medicinal purposes whilst spearmint is rarely used. The major uses of the mint oils and menthol are as flavouring and aromatic agents in toothpastes and mouthwashes, as well as in liqueurs and confectionery, especially chewing gum (Greenhalgh, 1979). No mint oleoresin is commercially available.

One of peppermint's major uses is in the preparation of peppermint tea, which is the most widely used of herbal teas, being very popular in many countries, especially West Germany and in North Africa where mint tea is a popular Arab beverage. Mint is also used in other beverages, including liqueurs (creme de menthe) and, in the USA, mint julep, whilst *M. citrata* (Eau de Cologne mint) is used in the liqueur known as chartreuse.

Peppermint and spearmint leaves are used in a variety of forms, including whole, rubbed, pulverised or as mint flakes. The whole leaf is particularly popular, but several traders complain of its limited availability.

PRODUCTION AND TRADE

Mint grows wild or is cultivated throughout the world but nearly all commercial produce is steam distilled for the essential oils. Whilst data exist on the production of mint oils there are no figures available on the level of commercial production of the herb itself. The USA, which is the dominant supplier of *M. piperita* and spearmint oils to the world market, had in 1977 an estimated 49,300 hectares under mint, but none of this was dried for use as a herb, producers finding production of the essential oil to be a more profitable proposition (Greenhalgh, 1979).

Many other countries grow peppermint and spearmint, including Hungary, Yugoslavia, Bulgaria, Romania, the UK, France, Egypt, the USSR, Morocco, Australia, New Zealand, Argentina, China, Brazil, Paraguay, Taiwan, Korea and Japan. Here again it is impossible to establish the proportion of production used for culinary purposes.

The only trade data available are for Yugoslavia and the USA, neither of which can be considered major suppliers or consumers of the herb. Yugoslav exports, shown in Table 22, have shown wide fluctuations from a peak of 648 tonnes in 1969 to a low of 87 tonnes in 1974. Over the period 1966 – 76 exports averaged almost 380 tonnes per annum. They increased to a peak in 1969, followed by a fluctuating fall in 1974, since when annual exports have risen rapidly, averaging almost 460 tonnes in 1975 and 1976. The major consumer of Yugoslavia's mint production has been West Germany, which has consistently taken over 75 per cent of her exports. The other major consumer has been France, but her share has fallen rapidly since 1973. Many other countries, including the USA, Italy, Belgium, Austria, Switzerland, Canada, Brazil and the UK, have taken very small quantities, but rarely exceeding 10 tonnes in any one year.

US imports of mint, shown in Table 23 and 24, are small in comparison to its other herb imports. It does, however import a higher proportion of processed mint than of any other processed herb. Imports of processed mint have risen quickly in recent years, reaching a peak of 37 tonnes in 1977, which was approximately 17 per cent of crude mint imports (see Table 24). The most important supplier of processed mint to the USA has been West Germany, but in

1976 and 1977 the UK, Yugoslavia, Egypt, Greece, Mexico and Brazil have supplied small quantities.

The trend of crude mint imports into the USA, shown in Table 24, is upwards, from a low of 13 tonnes in 1965 to 220 tonnes in 1977. Egypt now supplies more than half of the US requirements, West Germany, Yugoslavia and Bulgaria being the other major suppliers. In recent years Spain and Argentina have supplied relatively large quantities, but it is too soon yet to predict whether they will become major suppliers.

MARKETS

The consumption of mint in the **United Kingdom** is greater than that of any other herb. According to two major packers, the most commonly used variety in food flavouring is spearmint. There is a sizable domestic production of several hundred tonnes of the fresh herb, but nevertheless over 100 tonnes of imports are required annually to supplement local supplies, Egypt and Morocco appearing to be the major sources.

Another major market is the **Federal Republic of Germany** (West Germany), where mint is very popular in peppermint tea, but used rarely as a culinary herb. Whole leaves are also used for pharmaceutical purposes. Opinions differed as to the size of the market, some dealers suggesting it is small whilst, on the other hand, one of Germany's major herb dealers thought consumption could be over 2 000 tonnes. Production is undertaken in Bavaria but supplies are also imported in the whole or crushed form from Egypt, Hungary, Bulgaria and Spain.

The **Netherlands** is a small market. Spearmint is not very popular and no known manufacture of mint sauces is undertaken. As in West Germany, it is peppermint that is consumed and this almost entirely in herbal tea. One estimate suggested that 80 per cent is used in tea and for medicinal purposes, whilst the remainder is used in the retail sector. The same source indicated that 20 per cent of the Dutch market is supplied by domestic production, which is of the order of 20 – 30 tonnes. Egypt is the major source of imported supplies.

Although **France** is a major market for mint oils, the herb is not used very much and is rarely employed in French cooking. In **Spain** and **Italy** larger quantities of mint are used, but the availability of many other herbs and the inability of mint to combine well with garlic and other herbs tend to limit its use.

In Arab countries, as stated earlier, mint tea is a popular beverage, and mint is a common flavouring in North Africa, the Levant and the Middle East. Many Asian countries appreciate mint flavour and it is used in many recipes, including chutney. Whilst mint oils are extensively traded in these countries, there is no record of any international trade in the herb, and one must assume that most, if not all, mint leaf consumption is of domestically produced mint.

Mint herb is a very small item in the **USA**, although the mint flavour, as provided by the essential oil, is extremely popular in such items as chewing-gum, tooth-paste and confectionery. The US market for the traded herb probably does not exceed 250 tonnes, including the very small quantities of US commercially grown mint. Its major use is as a medicinal herb, especially in herb teas, the demand for which is growing in the USA. As a result, peppermint is more important than spearmint. The other major usage is in mint jelly, which is used as a flavouring for lamb, but consumption of the latter is insignificant in comparison with US consumption of beef.

PRICES

During the past decade the average fob unit price of mint sold to the USA has shown wide annual fluctuations, with a low of $1.00 per Kg in 1967 and a high of almost $2.00 per Kg in 1974. The price of mint has exhibited varying trends according to source. Thus Egyptian mint has remained relatively stable in price within the range of $1.03 – 1.28 per Kg, whilst the price of the smaller quantities of Bulgarian mint imported into the USA has shown wide variations, falling to a low of $0.85 per Kg in 1972 and then rising to $2.87 in 1976. In most years Bulgarian mint has been higher priced than Egyptian, whilst West German supplies have normally been higher than either, and the unit value of exports reached almost $4.00 per Kg in 1975 (see unit values Table 23). The unit value of processed mint has also shown wide fluctuation, but usually within the range of $4.00 – 6.00 per Kg in the 1970s (see Table 24).

PROSPECTS

Whilst mint is a most popular flavouring item the herb has limited uses and estimates of market size have been very difficult to obtain. Future demand is very much dependent upon the growth in demand for herbal teas and mint jelly. Herbal teas have been very popular in West Germany and Eastern Europe for many centuries, but it is only quite recently that a rapid growth has been noticed elsewhere. Whether this development is merely a short-term phenomenon is unknown, but currently there is a growing demand for mint, especially peppermint, for use in this form. Several trade sources also complain of their inability to purchase whole spearmint leaves of satisfactory quality, and it would seem that there is also a growing market for this product, in which a new producer could participate.

Table 22

Mint (plants): exports from Yugoslavia

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	203.8	360.1	553.3	648.1	535.1	250.3	362.3	249.7	87.3	559.4	358.7
	$'000	153.9	316.8	490.5	493.0	348.0	140.3	220.1	273.1	138.6	812.2	389.6
	$/Kg	0.76	0.88	0.89	0.76	0.65	0.56	0.61	1.09	1.59	1.45	1.09
of which to:												
Federal Republic of Germany	Tonnes	188.1	333.2	526.9	601.5	477.7	223.5	291.4	158.7	70.2	546.8	304.0
	$'000	141.2	293.9	461.3	455.4	310.2	126.1	175.3	146.4	110.0	787.7	331.5
	$/Kg	0.75	0.88	0.88	0.76	0.65	0.56	0.60	0.92	1.57	1.44	1.09
France	Tonnes	9.1	11.5	14.3	39.9	52.3	25.1	61.5	78.0	6.5	1.0	27.4
	$'000	6.5	9.9	13.1	29.9	31.9	13.0	38.4	103.4	7.1	1.8	23.9
	$/Kg	0.71	0.86	0.92	0.75	0.61	0.52	0.62	1.33	1.09	1.80	0.87
USA	Tonnes	–	2.6	2.0	–	2.0	–	5.0	11.0	5.0	5.5	8.5
	$'000	–	3.5	2.6	–	2.4	–	2.3	20.7	10.1	11.8	14.4
	$/Kg	–	1.35	1.30	–	1.20	–	0.46	1.88	2.02	2.15	1.69
Italy	Tonnes	3.7	2.0	1.0	4.0	1.2	1.1	2.2	–	2.2	2.1	4.2
	$'000	4.1	2.0	1.3	4.2	1.4	0.7	3.0	–	5.1	4.6	6.7
	$/Kg	1.11	1.00	1.30	1.05	1.17	0.64	1.36	–	2.32	2.19	1.60
Belgium	Tonnes	–	1.0	0.5	0.1	0.6	0.4	0.4	–	1.4	0.6	0.7
	$'000	–	0.3	0.5	–	0.7	0.3	0.3	–	2.4	0.8	0.6
	$/Kg	–	0.30	1.00	–	1.17	0.75	0.75	–	1.71	1.33	0.86
Austria	Tonnes	2.6	1.0	5.2	2.4	0.8	–	0.2	2.0	–	0.3	–
	$'000	1.9	0.3	7.5	3.3	1.1	–	0.2	2.5	–	0.5	–
	$/Kg	0.73	0.30	1.44	1.38	1.38	–	1.00	1.25	–	1.67	–
Switzerland	Tonnes	–	8.4	1.8	–	0.5	–	–	–	–	2.5	13.0
	$'000	–	6.2	2.2	–	0.3	–	–	–	–	3.4	11.1
	$/Kg	–	0.74	1.22	–	0.60	–	–	–	–	1.36	0.85
Other countries	Tonnes	0.3	0.4	1.6	0.2	–	0.2	1.6	0.1	2.0	0.6	0.9
	$'000	0.2	0.7	2.0	0.2	–	0.2	0.6	0.2	3.9	1.6	1.4

Source: Foreign Trade of Yugoslavia

Note: – nil or negligible

Table 23

Mint (crude): imports into the USA

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977[b]
TOTAL	Tonnes	41.3	13.2	20.0	36.8	45.4	54.0	34.7	51.3	106.9	80.4	113.0	136.7	138.1	219.8
	$'000[a]	53.0	14.0	26.0	37.0	61.7	63.5	39.1	63.7	108.6	103.6	219.3	232.2	227.6	313.5
	$/Kg	1.28	1.06	1.30	1.01	1.36	1.18	1.13	1.24	1.02	1.29	1.94	1.70	1.65	1.43
of which from:															
Egypt	Tonnes	...	...	...	16.5	9.4	21.8	13.2	1.6	30.9	43.6	31.9	64.6	71.1	142.3
	$'000	...	...	...	21.1	9.7	22.4	14.6	2.0	32.3	46.8	35.0	75.2	73.9	150.9
	$/Kg	...	...	...	1.28	1.03	1.03	1.11	1.25	1.05	1.07	1.10	1.16	1.04	1.06
Bulgaria	Tonnes	...	...	...	4.0	18.0	20.3	14.9	26.4	25.8	7.3	32.9	25.6	3.9	14.0
	$'000	...	...	...	5.4	25.9	24.9	12.9	30.8	21.9	14.5	46.5	40.4	11.2	33.6
	$/Kg	...	...	...	1.35	1.44	1.23	0.87	1.17	0.85	1.99	1.41	1.58	2.87	2.40
Federal Republic of Germany	Tonnes	...	...	...	1.0	9.5	3.4	1.0	6.3	21.7	18.9	30.1	14.0	34.4	8.7
	$'000	...	...	...	1.6	13.6	3.6	0.9	7.9	21.6	24.4	92.8	55.9	93.5	26.4
	$/Kg	...	...	...	1.60	1.43	1.06	0.90	1.25	1.00	1.29	3.08	3.99	2.72	3.03
Yugoslavia	Tonnes	...	...	...	–	3.9	2.5	0.5	2.5	9.0	5.0	10.8	–	1.7	23.0
	$'000	...	...	...	–	5.3	3.4	0.8	1.5	6.1	8.0	21.3	–	3.1	34.7
	$/Kg	...	...	...	–	1.36	1.36	1.6	0.60	0.68	1.60	1.97	–	1.82	1.51
Poland	Tonnes	...	...	...	0.5	3.0	1.0	–	4.4	1.9	–	1.2	–	–	–
	$'000	...	...	...	0.7	5.5	1.7	–	7.3	3.0	–	3.6	–	–	–
	$/Kg	...	...	...	1.40	1.83	1.70	–	1.66	1.58	–	3.00	–	–	–
Syria	Tonnes	...	...	...	–	–	–	2.0	2.0	2.5	0.7	1.7	0.3	0.5	3.6
	$'000	...	...	...	–	–	–	5.4	4.9	7.0	2.9	7.6	1.3	2.7	24.4
	$/Kg	...	...	...	–	–	–	2.70	2.45	2.80	4.14	4.47	4.33	5.40	6.78
Spain	Tonnes	...	...	...	–	–	–	–	–	5.0	1.4	1.0	25.5	6.8	6.8
	$'000	...	...	...	–	–	–	–	–	2.6	1.6	2.4	45.3	11.7	15.3
	$/Kg	...	...	...	–	–	–	–	–	0.52	1.14	2.40	1.78	1.72	2.25
UK	Tonnes	...	...	...	–	–	–	–	–	–	–	1.0	2.0	0.5	0.9
	$'000	...	...	...	–	–	–	–	–	–	–	1.6	3.7	1.4	2.1
	$/Kg	...	...	...	–	–	–	–	–	–	–	1.60	1.85	2.80	2.33

Table 23—*continued*

Mint (crude): imports into the USA

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977[b]
India	Tonnes	...	...	...	–	–	–	–	–	4.0	–	–	3.0	1.0	2.2
	$'000	...	...	...	–	–	–	–	–	3.0	–	–	2.9	1.6	2.6
	$/Kg	...	...	...	–	–	–	–	–	0.75	–	–	0.97	1.60	1.18
Romania	Tonnes	...	...	...	13.0	–	2.0	–	–	–	–	–	–	2.9	5.3
	$'000	...	...	...	5.7	–	2.4	–	–	–	–	–	–	6.2	7.5
	$/Kg	...	...	...	0.44	–	1.20	–	–	–	–	–	–	2.14	1.42
Lebanon	Tonnes	...	...	...	–	–	–	–	–	–	–	–	0.9	3.8	4.5
	$'000	...	...	...	–	–	–	–	–	–	–	–	4.2	3.5	4.1
	$/Kg	...	...	...	–	–	–	–	–	–	–	–	4.67	0.92	0.91
Argentina	Tonnes	...	...	...	–	–	–	–	–	–	–	–	–	10.0	–
	$'000	...	...	...	–	–	–	–	–	–	–	–	–	13.0	–
	$/Kg	...	...	...	–	–	–	–	–	–	–	–	–	1.30	–
China	Tonnes	...	...	...	–	–	–	–	–	–	–	–	–	–	3.0
	$'000	...	...	...	–	–	–	–	–	–	–	–	–	–	2.5
	$/Kg	...	...	...	–	–	–	–	–	–	–	–	–	–	0.83
Other countries	Tonnes	...	...	...	1.8	1.6	3.0	3.1	8.1	6.1	3.5	2.4	0.8	1.5	5.5
	$'000	...	...	...	2.5	1.7	5.1	4.5	9.3	11.1	5.4	8.5	3.3	5.8	9.4

Source: USDA Foreign Agriculture Circular, Tea and Spices, various issues

Notes: (a) Market value in country of origin, exclusive of import duty (if any), freight and insurance charges
(b) Preliminary
– nil or negligible
... not available

Table 24

Mint (other than crude): imports into the USA

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977[b]
TOTAL	Tonnes	14.6	8.6	20.2	11.7	32.6	4.9	5.0	13.1	17.9	24.4	14.8	25.4	34.3	36.9
	$'000[a]	15.3	14.6	24.6	23.4	42.7	25.3	25.1	58.8	74.0	88.6	90.1	152.7	138.2	186.4
	$/Kg	1.05	1.70	1.22	2.00	1.31	5.16	5.02	4.49	4.13	3.63	6.09	6.01	4.03	5.05
of which from:															
Federal Republic of Germany	Tonnes	2.0	2.6	8.2	3.0	4.7	4.8	5.0	12.3	13.7	10.9	13.7	19.3	20.5	22.7
	$'000	5.8	9.6	13.6	12.8	20.5	24.9	25.1	57.7	65.8	61.2	83.6	130.8	116.5	142.8
	$/Kg	2.90	3.69	1.66	4.27	4.36	5.19	5.02	4.69	4.80	5.61	6.10	6.78	5.68	6.29
UK	Tonnes	—	—	—	—	—	—	—	—	3.6	5.7	0.3	0.6	0.7	2.0
	$'000	—	—	—	—	—	—	—	—	5.3	17.6	2.1	4.4	3.6	16.1
	$/Kg	—	—	—	—	—	—	—	—	1.47	3.09	7.00	7.33	5.14	8.05
Switzerland	Tonnes	—	—	—	2.2	—	—	—	—	—	—	0.3	0.3	0.2	2.6
	$'000	—	—	—	4.1	—	—	—	—	—	—	3.2	3.4	3.2	14.4
	$/Kg	—	—	—	1.86	—	—	—	—	—	—	10.67	11.33	16.00	5.54
Yugoslavia	Tonnes	—	—	—	—	—	—	—	—	—	—	—	5.0	3.0	—
	$'000	—	—	—	—	—	—	—	—	—	—	—	10.6	4.9	—
	$/Kg	—	—	—	—	—	—	—	—	—	—	—	2.12	1.63	—
Egypt	Tonnes	7.2	4.2	7.0	5.5	—	—	—	—	—	—	—	—	7.0	—
	$'000	5.8	3.4	6.5	5.9	—	—	—	—	—	—	—	—	7.3	—
	$/Kg	0.81	0.81	0.93	1.07	—	—	—	—	—	—	—	—	1.04	—
Greece	Tonnes	—	—	—	—	25.4	—	—	—	—	—	—	—	—	5.1
	$'000	—	—	—	—	11.7	—	—	—	—	—	—	—	—	10.0
	$/Kg	—	—	—	—	0.46	—	—	—	—	—	—	—	—	1.96
Brazil	Tonnes	—	—	—	—	—	—	—	—	—	—	—	—	—	2.1
	$'000	—	—	—	—	—	—	—	—	—	—	—	—	—	1.3
	$/Kg	—	—	—	—	—	—	—	—	—	—	—	—	—	0.62
Other countries	Tonnes	5.4	1.8	5.0	1.0	2.5	0.1	—	0.8	0.6	7.8	0.5	0.2	2.9	2.4
	$'000	3.7	1.6	4.5	0.6	10.5	0.4	—	1.1	2.9	9.8	1.2	3.5	2.7	1.8

Source: USDA Foreign Agriculture Circulars, Tea and Spices, various issues

Notes: (a) Market value in country of origin, exclusive of import duty (if any) freight and insurance charges
(b) Preliminary
— nil or negligible

Chapter 11

Oregano

INTRODUCTION

In Chapter 9 on marjoram, the confusion in botanical nomenclature surrounding the herbs marjoram and oregano was mentioned. Oregano is also known as wild marjoram, origanum, oreganum, Mexican oregano, Mexican sage or Mexican marjoram. In Europe 'oregano' usually denotes *Origanum vulgare* of the Labiatae, or mint family, which is a hardy, erect, perennial herb, many branched, with creeping roots and growing to about 60 – 100 cm in height with purplish flowers. Oregano is somewhat taller and sturdier than sweet marjoram, and has darker, broader leaves which are about 16 mm long and of a light green colour when dried.

Oregano may be grown from seed or propagated by cuttings, and plantings may be productive for four to five years, although it is often grown as an annual. Oregano grows best in light, well-drained soil in a sunny position. For the full benefit of the aroma, oregano should be dried when in flower. When the herb grows in wet northern European climates, it is not very peppery in character, but the wild plant grown in southern Italy is a very pungent herb. In general oregano has a strong, aromatic flavour with an assertive, pleasantly bitter undertone.

Besides the European oregano, the culinary world recognises another major type of oregano, known as Mexican oregano. The two types are quite unrelated botanically but have a similar flavour. The European oregano is a milder herb, native to the Mediterranean region, whereas Mexican oregano is derived from small aromatic shrubs of the Verbenaceae family, for the most part *Lippia graveolens* or *L. berlandieri*, which are indigenous to the warmer areas of the western hemisphere, especially Mexico. In the US GRAS (Generally Recognised As Safe) list the classification is given as follows:

> 'Oregano (Mexican Oregano, Mexican Sage) usually *Lippia graveolens*, although species of *Origanum*, *Colens*, *Latana* and *Hyptio* may be similarly described'

Heath (1973) refers to a review in *Agricultural Botany* in which it is authoritatively stated that the condiment name 'oregano' is really to be understood to refer not to any one particular plant species but to a particular type of herb flavour and that this will vary in different parts of the world.

USES AND QUALITIES

Oregano is commonly called the pizza herb, reflecting its widespread use in flavouring pizza. The European oregano is particularly important in Italian cooking, being widely used with tomato, cheese, beans, aubergines, zucchini, fish, shellfish, gravies and meat, particularly beef and lamb. The more pungent Mexican variety is used in Mexican dishes, such as chilli con carne, chilli powder, enchilladas and tamales. Oregano, like basil, shows a particular affinity for tomato

and they are used, both together and separately, in dishes which include tomato products.

The dried herb, tincture and essential oil are all used by the flavour industry in certain liqueur formulations. The oil is used in compounded oils for flavouring meat, sauces and other products, and offers some competition for the dried herb. Production of oregano oleoresin appears to be negligible.

Most oregano is used in the leaf form although it is also available in the rubbed (crushed) and ground forms. The leaf is 16 mm in length, and the quality is measured by volatile oil, total and acid insoluble ash and moisture contents.

PRODUCTION AND TRADE

Oregano is produced in several countries, the major producer and exporter of Mexican-type oregano being Mexico, with small-scale production in the West Indies, mainly the Dominican Republic, Greece, Turkey, Morocco, France, Italy and Portugal produce the European oregano. The USA also commercially produces quantities of oregano.

Oregano (*Origanum vulgare*) is distributed throughout the greater part of Europe and the Middle East, in Iran and the area extending to the Indian subcontinent. It has been introduced into the Far East and is also cultivated in North America. Cultivation is becoming geographically widespread, but in several Mediterranean countries it is still collected from the wild.

Total production of oregano in Greece and Mexico has been estimated at about 1 600 tonnes per annum, but this is almost certainly an understatement (Heath, 1973). Table 25 shows Mexican exports of oregano, which in the period 1966 – 74 averaged 890 tonnes per annum, with a peak of almost 1 350 tonnes in 1974. The trend of exports has been upwards despite wide annual fluctuations. The USA has dominated Mexican export markets, taking over 90 per cent of her exports. The other markets, including those of Canada, Argentina, Italy, Brazil, the UK, Sweden, Puerto Rico, Costa Rica, Japan, West Germany, Panama, Australia, Cuba, Switzerland and the Netherlands are all totally insignificant in comparison to that of the USA.

Export data are only available for two other countries, namely the Dominican Republic and Peru, but these data do not exist beyond 1971 and 1969, respectively. Both appear to be relatively small producers in comparison with Mexico. The Dominican Republic's exports averaged 24 tonnes in the period 1966 – 71, with a peak of 54 tonnes in 1966. Puerto Rico was the major market for Dominican production, followed by the USA (see Table 26). Peru's exports averaged 118 tonnes for the period 1966 – 69, of which an average of almost 100 tonnes per annum was destined for Argentina (see Table 27). Other, much smaller, markets for Peruvian oregano include Brazil, the USA, Sweden, Bolivia, Chile, Uruguay, Ecuador and Canada.

The available export data almost certainly refer to 'Mexican' oregano, no data being available on the exports of European oregano other than those incorporated in the US import figures (Tables 28 and 29). Table 29 shows US imports of processed oregano and these are very small, averaging only 8 tonnes per annum in the period 1964 – 77, with a peak of 17 tonnes in 1975. Greece and Mexico supplied most of these imports, whilst small contributions were made by the Dominican Republic, the UK, Turkey and Japan.

Imports of oregano 'crude or not manufactured' into the USA are considerably greater, averaging 1 656 tonnes per annum for the period 1964 – 77, with a peak of 2 580 tonnes in 1977 (see Table 28). Despite annual fluctuations the trend in imports has been upwards. There have been three major sources of supply, Greece, Mexico and Turkey. Supplies from Greece rose from almost 500 tonnes

in 1964 to a peak of 1 080 tonnes in 1972; they then fell to low levels in 1974 and 1975, but rose to 1 035 tonnes in 1976 only to fall again to 877 tonnes in 1977. The falls in 1974, 1975 and 1977 were almost certainly results of production shortfalls since the unit price rose rapidly in these years. Mexican supplies showed a different trend, rising throughout the 1960s, and doubling between 1969 and 1970 to 1 131 tonnes, followed by wide fluctuations in the early 1970s. Nevertheless the trend of Mexican exports is upwards. Supplies from Turkey were very small or nil during the 1960s and early 1970s, but from zero imports in 1972 they have increased rapidly reaching 286 tonnes in 1977. Besides Greece and Mexico, only France and the Dominican Republic have been regular suppliers to the American market, but both have been of minor importance, averaging only 10 tonnes and 18 tonnes per annum respectively for the period 1964 – 77. Other sporadic suppliers to the USA include Portugal, Spain, Italy, Yugoslavia, Romania, Canada, the Philippines, India, Hungary, Indonesia, the Bahamas, Japan, Madagascar and the Seychelles. In recent years the South American countries of Peru, Brazil and Chile have supplied increasing quantities to the US market. It should be stressed again that these statistics must be treated with great care because oregano and marjoram are frequently mixed, depending on their supply and price relationships. Hence the oregano import statistics almost certainly include some marjoram, and vice versa.

MARKETS

The United States of America

According to Rosengarten there was little interest in oregano in the USA before the Second World War, but during the war many American soldiers in Italy developed a liking for pizza and on their return started the 'pizza craze'. This has led to oregano becoming the major imported herb in the USA and yearly consumption is over 2 000 tonnes. For pizza and Italian-type foods the European oregano is employed, whilst in Mexican style foods, which have shown an enormous growth in popularity in recent years, Mexican oregano is used. The industrial and food service sectors' use of oregano is becoming much larger. Chain restaurants are buying increasing quantities of canned pizza sauce, which includes oregano and basil as basic ingredients.

Mexican oregano is also used in Italian-style food in the Western USA, because of its proximity and availability. On the other hand, on the East coast European oregano is used for Italian foods. Many trade sources, however, believe that the two types of oregano are not immediate substitutes for one another, and there would have to be a considerable price increase in one to induce a rise in demand for the other. Demand for the herb tends to be regional; the West coast and the South consume the hotter Mexican variety and the East coast the milder European type, but the movement westward has helped to increase usage of the European type, whilst Mexican cooking is moving eastwards.

Other markets

The USA dominates the market for oregano, other countries being minor consumers in comparison. **Italy** is probably the next major market, but no data are available, except to the extent that local production satisfies much of this market.

The **French** market for oregano probably exceeds 500 tonnes per annum with supplies being obtained both locally and from other countries, including Morocco, Spain, Greece, Turkey, Italy, Yugoslavia and Bulgaria. Pizza preparations are a major outlet for the herb.

The Federal Republic of Germany (West Germany) consumes approximately 200 tonnes of oregano annually and in the last few years the demand has been increasing faster than for any other herb, mainly because of the pizza boom.

Hence most demand emanates from the food service sector. The main supplier is Greece, followed by Turkey, but the latter is reputed to provide oregano of better quality.

The **Netherlands** is also experiencing a rapid growth in demand associated with the expansion of the pizza trade, and current usage is estimated at 50 – 60 tonnes per annum, although one important dealer suggested 200 tonnes. Supplies are obtained mainly from Greece and Turkey, with small quantities from Spain and Egypt.

According to one source, oregano only became known in **Switzerland** since the Second World War when large numbers of Italian migrant workers arrived. Preference is for oregano from Crete and Greece, and very occasionally from Egypt, although supplies from the last may be marjoram. Sicilian oregano is considered the best but is unobtainable, whilst French supplies are also considered to be of good quality. Again pizza would seem to be the almost exclusive end-use, both by industry and in the household. For the **United Kingdom** and **Belgium** consumption is estimated at 10 – 20 tonnes per annum, but is showing a strong upward trend. In all European markets the demand for Mexican oregano seems very small, but this could well be because of its unavailability.

Japan also consumes small quantities of oregano, estimated at around 20 tonnes per annum, mainly of the European variety. Japan exported 38 tonnes to the USA in 1968, but since no evidence of production in Japan exists, these were probably re-exports.

PRICES

Oregano prices have shown wide fluctuations in recent years. This can be seen from Table 28, showing the fob unit values of US imports which were relatively static between 1964 and 1973 when they ranged from $0.47 per Kg to $0.64 per Kg. Between 1973 and 1974 prices rose almost four-fold from $0.64 to $2.36 per Kg, and then declined to $1.09 per Kg in 1976, rising to $1.42 per Kg in 1977. The New York spot prices, also shown in Table 28, exhibited a similar trend, reaching a peak of $3.42 – 3.64 in 1978. Since oregano comes from two distinct sources, it is important to analyse price trends for both the European and Mexican varieties. The fob unit value of Greek oregano has been consistently almost double that of the Mexican variety, except in 1977 when both appeared to be in short supply and prices rose above the $2.00 level. Turkish unit values have usually been below those of Greek oregano, but above those of the Mexican type. French sources also suggest a wide range of prices from 2.50 to 7.00 FF per Kg according to quality, which is wider than for most other herbs. In Germany quoted prices are 3.00 – 5.00 DM per Kg, again depending upon quality.

PROSPECTS

Oregano consumption is probably growing faster than consumption of any other major herb, and hence production of the herb can be recommended to new producers. Future growth is very much dependent on the growth of demand for pizzas and Mexican-style cooking. Both Mexican and European oregano are increasing in popularity, with the USA being by far the most important market for both. Some US trade sources argue that, since Mexican oregano grows wild there, considerable quantities are available and no supply problems are anticipated. Assuming that these assertions prove correct over time, a new producer should initially attempt to produce the European variety (*Origanum vulgare*). Moreover, whilst the Mexican variety is rarely consumed in Europe, the European variety has sizable markets in Europe and elsewhere, especially in the USA.

Table 25

Origanum: exports from Mexico

		1966	1967	1968	1969	1970	1971	1972	1973	1974[a]
TOTAL	Tonnes	762.2	655.5	732.8	576.3	1 323.4	841.6	748.2	1 028.3	1 349.2
	$'000	194.3	139.9	148.4	132.6	328.4	212.0	222.9	435.4	837.8
	$/Kg	0.25	0.21	0.20	0.23	0.25	0.25	0.30	0.42	0.62
of which to:										
USA	Tonnes	745.9	632.8	690.3	532.6	1 252.7	816.6	705.1	1 022.8	1 316.8
	$'000	191.1	135.5	139.7	125.0	315.0	207.8	218.1	434.0	820.4
	$/Kg	0.26	0.21	0.20	0.23	0.25	0.25	0.31	0.42	0.62
Canada	Tonnes	5.9	7.1	6.2	4.5	7.3	7.7	12.6	–	18.1
	$'000	0.7	0.8	0.7	0.5	0.8	0.9	1.4	–	13.6
	$/Kg	0.12	0.11	0.11	0.11	0.11	0.12	0.11	–	0.75
Argentina	Tonnes	3.2	0.5	32.8	32.4	41.1	9.0	2.5	–	3.0
	$'000	1.7	0.2	7.6	6.4	8.2	2.4	0.2	–	0.7
	$/Kg	0.53	0.40	0.23	0.20	0.20	0.27	0.08	–	0.23
Italy	Tonnes	2.0	–	–	–	6.0	2.5	7.5	2.5	–
	$'000	0.2	–	–	–	0.7	0.3	0.9	0.6	–
	$/Kg	0.10	–	–	–	0.12	0.12	0.12	0.24	–
Other countries	Tonnes	5.2	15.1	3.5	6.8	16.3	5.8	20.5	3.0	11.3
	$'000	0.6	3.4	0.4	0.7	3.7	0.6	2.3	0.8	3.1

Source: Estadistico Anuario del Comercio Exterior – Mexico

Notes: (a) Since 1974 no export data is available
– nil or negligible

Table 26

Origanum: exports from the Dominican Republic

		1966	1967	1968	1969	1970	1971
TOTAL	Tonnes	54.1	26.7	3.3	20.4	27.7	13.7
	$'000	14.8	8.3	1.3	8.2	7.8	7.0
	$/Kg	0.27	0.31	0.39	0.40	0.28	0.51
of which to:							
Puerto Rico	Tonnes	33.6	14.2	3.3	16.0	27.6	11.7
	$'000	8.7	4.4	1.3	6.2	7.8	5.9
	$/Kg	0.26	0.31	0.39	0.39	0.28	0.50
USA	Tonnes	20.5	12.4	–	4.4	–	2.0
	$'000	6.1	3.9	–	2.0	–	1.0
	$/Kg	0.30	0.31	–	0.45	–	0.50
Other countries	Tonnes	–	0.1	–	–	–	–
	$'000	–	–	–	–	–	–

Source: Comercio Exterior de la Republica Dominicana

Notes: Since 1971 no export data on origanum is available
– nil or negligible

Table 27

Origanum: exports from Peru

		1966	1967	1968	1969
TOTALS	Tonnes	145.4	127.9	100.4	99.5
	$'000	80.4	59.3	54.9	73.5
	$/Kg	0.55	0.46	0.55	0.74
of which to:					
Argentina	Tonnes	124.3	115.0	90.9	57.9
	$'000	68.8	55.1	49.5	42.7
	$/Kg	0.55	0.48	0.54	0.74
Brazil	Tonnes	5.0	2.5	3.1	12.9
	$'000	2.9	1.3	1.7	10.0
	$/Kg	0.58	0.52	0.55	0.78
USA	Tonnes	8.1	3.0	2.0	4.5
	$'000	5.5	1.6	1.0	3.2
	$/Kg	0.68	0.53	0.50	0.71
Sweden	Tonnes	7.0	–	1.0	4.0
	$'000	2.3	–	0.6	3.7
	$/Kg	0.33	–	0.60	0.93
Chile	Tonnes	–	–	–	16.1
	$'000	–	–	–	11.4
	$/Kg	–	–	–	0.71
Other countries	Tonnes	1.0	7.4	3.4	4.1
	$'000	0.9	1.3	2.1	2.5

Source: Estadistica del Comercio Exterior, Peru

Notes: Since 1969 no export data on origanum is available
– nil or negligible

Table 28

Origanum (crude or not manufactured): imports into the USA and spot prices

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977 (b)	1978
TOTAL	Tonnes	771.7	814.7	1 144.9	1 257.3	1 487.3	1 413.6	2 135.9	1 754.1	1 723.3	2 159.0	1 457.0	2 292.0	2 195.3	2 580.4	...
	$'000 (a)	363.1	421.3	730.4	701.6	781.7	789.0	1 169.5	1 018.8	1 074.1	1 373.8	3 431.3	3 112.6(a)	2 392.2(a)	3 661.5	...
	$/Kg	0.47	0.52	0.64	0.56	0.53	0.56	0.55	0.58	0.62	0.64	2.36	1.36	1.09	1.42	...
of which from:																
Greece	Tonnes	496.4	490.0	792.3	779.2	914.5	845.4	938.0	917.3	1 079.5	1 058.0	890.1	857.8	1 035.2	876.9	...
	$'000	262.1	317.3	578.3	515.7	563.1	581.4	742.3	699.8	815.5	859.1	2 118.5	1 712.2	1 396.7	1 940.7	...
	$/Kg	0.53	0.65	0.73	0.66	0.62	0.69	0.79	0.76	0.76	0.81	2.38	2.00	1.35	2.21	...
Mexico	Tonnes	219.5	280.0	254.7	424.0	522.6	526.8	1 130.7	797.4	619.9	992.2	374.8	1 253.0	876.1	1 245.1	...
	$'000	71.8	84.3	113.3	157.5	188.5	188.0	389.2	296.7	247.1	457.1	846.7	1 142.1	687.6	926.8	...
	$/Kg	0.33	0.30	0.44	0.37	0.36	0.36	0.34	0.37	0.40	0.46	2.26	0.91	0.78	0.74	...
Dominican Republic	Tonnes	18.4	8.5	50.1	18.6	2.9	17.2	25.9	9.5	18.6	6.7	17.9	19.1	30.3	2.2	...
	$'000	7.8	3.1	20.2	6.9	1.1	5.5	8.3	3.6	8.0	5.0	44.6	12.0	26.2	1.4	...
	$/Kg	0.42	0.36	0.40	0.37	0.38	0.32	0.32	0.38	0.43	0.75	2.49	0.63	0.86	0.64	...
France	Tonnes	4.8	7.1	7.4	9.8	–	16.8	7.3	5.0	5.0	5.0	1.8	6.5	10.0	49.7	...
	$'000	3.7	4.9	4.8	6.2	–	10.5	4.2	2.7	3.2	3.2	4.1	6.4	11.5	66.1	...
	$/Kg	0.77	0.69	0.65	0.63	–	0.63	0.58	0.54	0.64	0.64	2.28	0.98	1.15	1.33	...
Turkey	Tonnes	17.6	24.2	2.9	21.7	4.8	–	–	–	–	57.5	153.9	150.7	233.3	286.2	...
	$'000	5.7	10.4	1.4	13.5	2.7	–	–	–	–	37.4	372.0	234.3	249.1	557.6	...
	$/Kg	0.32	0.43	0.48	0.62	0.56	–	–	–	–	0.65	2.42	1.55	1.07	1.95	...
Spain	Tonnes	10.0	–	1.8	–	–	–	22.8	20.0	–	4.5	1.8	–	10.0	–	...
	$'000	9.0	–	1.2	–	–	–	16.0	14.0	–	3.4	4.6	–	18.4	–	...
	$/Kg	0.90	–	0.67	–	–	–	0.70	0.70	–	0.76	2.56	–	1.84	–	...
Italy	Tonnes	5.0	–	–	2.1	–	–	–	–	–	–	–	–	0.4	15.0	...
	$'000	2.9	–	–	1.2	–	–	–	–	–	–	–	–	2.7	29.2	...
	$/Kg	0.58	–	–	0.57	–	–	–	–	–	–	–	–	6.75	1.95	...
Yugoslavia	Tonnes	–	–	–	–	–	–	–	–	–	–	–	4.9	–	14.5	...
	$'000	–	–	–	–	–	–	–	–	–	–	–	5.6	–	20.0	...
	$/Kg	–	–	–	–	–	–	–	–	–	–	–	1.14	–	1.38	...

Table 28—*continued*

Origanum (crude or not manufactured): imports into the USA and spot prices

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977[(b)]	1978
Peru	Tonnes	–	–	–	–	–	–	–	–	–	–	15.4	–	–	15.0	...
	$'000	–	–	–	–	–	–	–	–	–	–	37.6	–	–	16.7	...
	$/Kg	–	–	–	–	–	–	–	–	–	–	2.44	–	–	1.11	...
Brazil	Tonnes	–	–	–	–	–	–	–	–	–	–	–	–	–	15.0	...
	$'000	–	–	–	–	–	–	–	–	–	–	–	–	–	30.4	...
	$/Kg	–	–	–	–	–	–	–	–	–	–	–	–	–	2.03	...
Chile	Tonnes	–	–	–	–	–	–	–	–	–	–	–	–	–	37.7	...
	$'000	–	–	–	–	–	–	–	–	–	–	–	–	–	46.9	...
	$/Kg	–	–	–	–	–	–	–	–	–	–	–	–	–	1.24	...
Malagasy Republic	Tonnes	–	–	–	–	–	–	–	–	–	–	–	–	–	5.0	...
	$'000	–	–	–	–	–	–	–	–	–	–	–	–	–	2.8	...
	$/Kg	–	–	–	–	–	–	–	–	–	–	–	–	–	0.56	...
Seychelles	Tonnes	–	–	–	–	–	–	–	–	–	–	–	–	–	10.0	...
	$'000	–	–	–	–	–	–	–	–	–	–	–	–	–	5.2	...
	$/Kg	–	–	–	–	–	–	–	–	–	–	–	–	–	0.52	...
Other countries	Tonnes	–	4.9	35.7	1.9	42.5	7.4	11.2	4.9	0.3	35.1	1.3	–	–	8.1	...
	$'000	–	1.3	11.2	0.6	26.3	3.6	9.5	2.0	0.3	8.6	3.2	–	–	17.7	...
Approximate New York spot prices as of early March ($/Kg)																
Greek		...	...	...	...	...	...	0.87	0.94	0.93	0.94	2.92	2.60	1.63	...	3.42–3.64
Mexican		...	...	...	...	...	...	0.66	0.68	0.71	...	2.04	1.91	1.40	...	1.98

Source: USDA Foreign Agriculture Circular, Tea and Spices, various issues

Notes: (a) Market value in country of origin, exclusive of import duty (if any), freight and insurance charges
(b) Preliminary
– nil or negligible
... not available

Table 29

Origanum (except crude): imports into USA

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977[b]
TOTAL	Tonnes	4.4	4.4	2.3	–	–	11.0	29.5	1.4	5.9	13.2	4.9	16.6	4.5	11.8
	$'000[a]	2.3	2.5	1.6	–	–	5.1	14.1	1.6	3.3	11.0	10.4	25.3	7.3	15.5
	$/Kg	0.52	0.57	0.70	–	–	0.46	0.48	1.14	0.56	0.83	2.12	1.52	1.62	1.31
of which from:															
Greece	Tonnes	4.4	...	...	–	–	–	1.8	–	0.9	3.2	3.6	1.2	0.1	2.7
	$'000	2.3	...	...	–	–	–	1.5	–	0.5	2.3	7.6	2.9	0.4	5.9
	$/Kg	0.52	...	...	–	–	–	0.83	–	0.56	0.72	2.1	2.42	4.00	2.19
Mexico	Tonnes	–	...	...	–	–	11.0	26.7	–	5.0	–	0.4	–	4.2	5.0
	$'000	–	...	...	–	–	5.1	11.8	–	2.8	–	0.3	–	6.0	4.5
	$/Kg	–	...	...	–	–	0.46	0.44	–	0.56	–	0.75	–	1.43	0.90
UK	Tonnes	–	...	...	–	–	–	–	–	–	–	–	15.4	–	–
	$'000	–	...	...	–	–	–	–	–	–	–	–	22.4	–	–
	$/Kg	–	...	...	–	–	–	–	–	–	–	–	1.45	–	–
Other countries	Tonnes	–	...	...	–	–	–	1.0	1.4	–	10.0	0.9	–	0.2	4.1
	$'000	–	...	...	–	–	–	0.8	1.6	–	8.7	2.5	–	0.9	5.1

Source: USDA Foreign Agriculture Circular, Tea and Spices, various issues

Notes: (a) Market value in country of origin, exclusive of import duty (if any), freight and insurance charges
(b) Preliminary
– nil or negligible
... not available

Chapter 12

Parsley

INTRODUCTION

Parsley is one of the best known and most widely used herbs, partly because of its diverse uses and widespread cultivation. Many cultivated varieties exist, the principal ones being the curled- or moss-leaved types (*Petroselinum crispum*), the Hamburg or parsnip-rooted type (*P. sativum*) cultivated for its fleshy root, and others inciuding the Neapolitan or celery-leaved type, the fern-leaved type and the plain-leaved or Italian-type parsley. However, it should be noted that Chinese or Japanese 'parsley' is actually green coriander with a very different taste from true parsley.

Parsley is a hardy biennial or short-lived perennial, often grown as an annual. Propagation is by seed, and parsley requires an ordinary well-worked but moist soil; a partially shaded position is best. Plain-leaved parsleys are hardier than the curled-leaf types. The plant grows to about 30 cm in height, with spindle-shaped roots, ternately pinnate leaves with toothed, ovate leaflets, yellowish-green flowers and ovoid fruits. The seeds are produced in the second year and then each subsequent year as long as the plant lasts. The colour of the dried herb is green, the aroma is pleasant, characteristic, fragrant and spicy. There is some debate as to which variety has the best flavour, but this appears to depend as much on soil and climate as on variety.

Parsley is used for the most part in the fresh state, but it is not always available in this form, and in any case has a limited life as such even when refrigerated. As a result parsley is now widely available in dehydrated form, techniques of dehydration having improved considerably since the Second World War. According to Rosengarten (1973), about twelve parts of de-stemmed parsley are required to produce one part of the dehydrated product, and in preparing this product the stems, which represent about 50 per cent of the weight of the plants, are discarded before the main drying operations begin. A major Californian parsley producer requires less than 2 hours for completion of the entire parsley dehydration process from harvesting to packaging.

USES AND QUALITIES

The leaves, flowering tops, ripe seeds, roots, essential oils and oleoresin of parsley are all used for a variety of purposes. The aerial part is the most commonly used and in both its fresh and dehydrated form is widely used for culinary purposes. The leaves are often finely chopped and used as a seasoning and garnish in sauces, soups, rissoles, minces and other meats, salads, poultry, fish and vegetables. Because of its unassertive flavour parsley combines well with other herbs in many dishes, and it is a complementary ingredient of 'fines herbes' mixtures and 'bouquet garni'. The stems are also dried and powdered for use both as a culinary colouring and for dyeing purposes. The Neapolitan or celery-leaved parsley is grown for the use of its leafstalks, which are blanched and eaten

like celery. The Hamburg or parsnip-rooted variety is cultivated for its fleshy root, which is eaten as a vegetable and used as a flavouring in several European countries. There are markets for the seeds, both as a supply for growers and as a source of essential oil. Three essential oils are obtained from parsley: parsley seed oil, obtained by steam distillation of the ripe seeds; parsley leaf oil, from the leaves and the flowering tops; and parsley herb oil, from distillation of the whole plant. An oleoresin is also obtained from the seeds, and the essential oils and oleoresins are used for the flavouring of cured and canned meats and condiments, and in the formulation of compounded aromas. However, parsley oleoresin usage is extremely limited. The essential oils also find limited use in perfumery. Other derivatives include infusions and decoctions, obtained from the leaves and roots and used only for pharmacological purposes. The roots, fruits and aerial parts all have some medicinal uses, although those are very limited.

In the USA the final moisture content of dehydrated parsley is about 4 per cent. Parsley leaves are sold commercially as flakes or granules, while it is the leaves and stems which are ground. No detailed quality specifications have been seen, but the product must look fresh and green, with no traces of yellow colour.

PRODUCTION AND TRADE

Parsley grows wild or is cultivated throughout the world. A large proportion of production is consumed domestically and does not enter international trade. For example, the USA is probably the world's major commercial producer of parsley, with an estimated production of dehydrated parsley of approximately 750 – 1 000 tonnes per annum, the vast majority of which is consumed in the USA. In fact, parsley is the major herb grown in the USA, commercial production being undertaken in California, Texas and Arizona by three major producers. Production in the USA in the early 1960s was estimated to be in excess of 30,000 tonnes per annum, and is now probably much greater (Van Arsdel and Copley, 1964). Three types of parsley are grown, curled, plain-leaved and parsnip-rooted, but it is the former that is used for dehydration.

Although the USA produces most of its own parsley, the rapid increase in demand for it in recent years is reflected in a growing volume of imports. Table 31 shows US imports of crude parsley, which rose from an annual average of only 7 tonnes in the period 1967 – 69 to 195 tonnes in 1975 – 77, with a peak of 258 tonnes in 1977. There are two major suppliers of crude parsley to the USA, the Dominican Republic (the larger supplier) and Mexico, which together usually account for over 95 per cent of US imports. An interesting feature of 1977 imports has been supplies from India and Indonesia of 30 tonnes and 5 tonnes respectively. Canada has occasionally exported sizable but irregular quantities to the USA, whilst West Germany, Haiti, France, Hungary, Yugoslavia, Belgium, Italy and Venezuela have all supplied the US market with small quantities on an irregular basis; in no year has the USA imported more than 2.5 tonnes from any of these countries.

The USA also imports processed parsley, and as Table 32 illustrates, imports have shown wide annual variations with no discernible trend. During the 1970s imports averaged 22 tonnes per annum, with Hungary being the dominant supplier, and with smaller contributions from the Dominican Republic, West Germany and Mexico.

The USA has in recent years exported small quantities of its production to Europe, but it is too early yet to establish whether this will be a continuing trend or merely a response to short-term shortages created by the 1976 drought.

In the USA and the UK the curly-leaved varieties are the major types grown, but in other countries the plain-leaved variety is the more usual, the curly-leaved type being almost unknown. The UK, like the USA, produces much of its own parsley, annual production being estimated at over 1 000 tonnes. Other important

producers of parsley, for which no production estimates are available, include West Germany, the Dominican Republic, Mexico, Egypt, Hungary and Yugoslavia.

Only Spain provides data on parsley exports and these are shown in Table 30. From 1966 to 1976 Spain exported an average of 25 tonnes per annum, with a peak of 72 tonnes in 1968 and a low of 2 tonnes in 1974. The trend of Spanish exports has been downwards. No one country dominates Spanish export markets, but West Germany, France and Switzerland have between them purchased a substantial proportion of the total, whilst a dozen other countries have imported irregular and usually very small quantities.

MARKETS

The United States of America

Parsley is very popular in the USA and, according to one reliable source, virtually all parsley is used as a garnish rather than as a seasoning. Unfortunately, no data are available on the proportions of fresh and dehydrated parsley consumed, but whilst many believe that the fresh parsley market is larger than the market for dehydrated parsley, all sources consulted agree that the demand for dehydrated parsley is growing very rapidly, and that it is replacing fresh parsley. Future demand prospects are also thought to be extremely good, but quality is a vital consideration. The domestically-produced parsley, which satisfies nearly all USA consumption, is a superior green colour when dehydrated, whereas all the foreign-produced parsley is darker and less visually attractive; since parsley is mainly used as a garnish, this is a very important consideration. Despite its high price, Californian-produced parsley is in demand in Europe. Nevertheless, as pointed out in the previous section, the USA is increasingly dependent on imported supplies of parsley (see Table 31 and 32). Several US processors spoke of packaging and labelling difficulties arising from the fact that imported parsley tends to have a different bulk index (ie weight to volume ratio) from domestically-produced parsley, and this could give rise to initial problems for any new producer seeking to market his product in the USA.

Other markets

Parsley is one of the most popular herbs in **West Germany**, but parsley imports are very small as southern Germany is an important producing area. Recently, however, a German company has begun producing parsley in Kenya, where the crop is able to grow the whole year round, and, according to one source, the quality appears excellent. This fact, together with the occasional imports from Hungary, Spain and Yugoslavia, would suggest that a new producer could sell to the German market, provided quality was high. As in the UK, the existence of substantial domestic production of parsley and the availability of both a fresh and a dried product make estimation of market size difficult. Estimates of dehydrated parsley consumption varied and ranged from 200 to 1 000 tonnes per annum. Fresh parsley is preferred to dehydrated parsley but, as in the USA, consumption of the latter appears to be growing much faster. The retail sector is the major outlet.

The **Netherlands** also supplies much of its own requirements, but imports some 20 – 25 tonnes per annum from Eastern Europe, France and Egypt. Most parsley is consumed by the retail sector. **Belgium** relies mainly on imports, which one major dealer estimated to be 15 – 20 tonnes per annum.

The **United Kingdom** only imports parsley when domestic production fails to meet market requirements. In general, imports into the UK are a very small proportion of total consumption which one source has estimated at over 1 000 tonnes per annum. Parsley is certainly among the top three herbs consumed in the UK, the other two being mint and sage.

France produces sizable quantities of parsley to satisfy a market estimated at over 300 tonnes per annum, but it is also reliant on imports from Eastern Europe, particularly Hungary, as well as from West Germany and Italy, for some of its requirements.

Switzerland's demand for parsley is small, the herb being used mainly in the retail sector and in soup manufacturing. One source indicated that the preference is for fresh parsley.

Japan is a producer of fresh parsley, but the rising demand has to be met in part from imported supplies, mainly from the USA but also from France and West Germany. In spite of growth, the market remains very small.

PRICES

The available unit value series on parsley, shown in Tables 30 and 31, are not an entirely reliable guide to trends, partly because of the small quantities involved. Nevertheless Table 31 does show the upward trend in crude parsley values, a trend which is corroborated by evidence from the trade. Thus the unit fob value of US imports rose from $0.22 per Kg in 1964 to a peak of $0.86 per Kg in 1977. The data in this table also show that annual variation in fob values for parsley from different sources. Thus, parsley from the Dominican Republic is much higher-priced than that from Mexico, no doubt reflecting quality differences. It is interesting to note that in 1977 the USA's first imports from India had a much higher unit value than those from the Dominican Republic. Fob unit values of manufactured parsley imports into the USA have shown remarkable stability during the decade 1967–76, varying between $0.91 per Kg in 1971 and $1.21 in 1968. However, in 1977 they rose to $1.60 per Kg. Discussions with the trade in West Germany suggest that the normal price for dehydrated parsley is around 5 DM per Kg, although the 1976 drought caused an increase to 8 DM per Kg. French prices range from 10 to 18 FF per Kg depending on quality which, according to one dealer, can vary considerably even from the same source.

PROSPECTS

The market for dehydrated parsley should continue to expand and there is certainly room for new producers. However, a new producer must be able to satisfy the high quality requirements of this market, both as regards colour and bulk index, and this will necessitate a complete mastering of growing, harvesting and dehydration techniques, in order to produce a product of pleasing appearance. In addition, a new producer will have to compete with established companies producing dehydrated parsley, not only in the USA but also in West Germany, the UK, Hungary, Canada, Spain and France, most of whom are able to sell their product at a current fob value of around $1.25 per Kg.

Table 30

Parsley: exports from Spain

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	41.2	15.3	72.0	13.0	20.0	25.0	24.0	21.0	1.5	22.0	23.0
	$'000	18.0	6.5	26.7	4.8	7.5	9.5	11.3	9.7	0.8	6.7	7.4
	$/Kg	0.44	0.42	0.37	0.37	0.38	0.38	0.47	0.46	0.53	0.30	0.32
of which to:												
Federal Republic of Germany	Tonnes	27.1	4.5	16.6	5.0	13.0	12.0	7.0	1.0	–	10.0	0.4
	$'000	11.9	2.0	6.2	2.0	4.9	4.8	3.1	0.5	–	2.6	0.1
	$/Kg	0.44	0.44	0.37	0.40	0.38	0.40	0.44	0.50	–	0.26	0.25
France	Tonnes	4.8	–	51.5	4.0	4.0	7.0	0.1	1.0	0.7	–	14.0
	$'000	2.1	–	19.4	1.8	1.6	2.8	–	0.7	0.3	–	5.8
	$/Kg	0.44	–	0.38	0.45	0.40	0.40	0.30	0.70	0.43	–	0.41
UK	Tonnes	2.0	0.5	0.2	1.0	–	1.0	3.0	–	0.3	–	–
	$'000	0.9	0.2	0.1	0.7	–	0.6	1.5	–	0.1	–	–
	$/Kg	0.45	0.40	0.50	0.70	–	0.60	0.50	–	0.33	–	–
Switzerland	Tonnes	6.4	4.8	2.4	0.3	2.0	2.0	12.0	16.0	–	–	–
	$'000	2.8	2.1	0.9	0.1	1.0	0.8	4.9	7.5	–	–	–
	$/Kg	0.44	0.44	0.38	0.33	0.50	0.40	0.41	0.47	–	–	–
Mauritania	Tonnes	–	0.2	0.1	0.6	–	–	0.7	1.0	0.5	–	–
	$'000	–	–	–	0.1	–	–	0.1	0.8	0.3	–	–
	$/Kg	–	0.24	0.20	0.17	–	–	0.14	0.80	0.60	–	–
Other countries	Tonnes	0.9	5.3	1.2	2.1	1.0	3.0	1.2	2.0	–	12.0	8.6
	$'000	0.3	2.2	0.1	0.1	–	0.5	1.7	0.2	0.1	4.1	1.5

Source: Estadistica del Comercio Exterior de España

Note: –nil or negligible

Table 31

Parsley (crude): imports into the USA

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977 (b)
TOTAL	Tonnes	4.5	–	12.7	9.8	5.8	4.8	50.2	9.6	28.3	34.7	82.6	99.3	228.5	257.9
	$'000 (a)	1.0	–	5.0	3.7	1.6	1.6	19.1	7.2	21.6	15.1	52.6	62.2	153.9	222.3
	$/Kg	0.22	–	0.39	0.38	0.28	0.33	0.38	0.75	0.76	0.44	0.64	0.63	0.67	0.86
of which from:															
Dominican Republic	Tonnes	...	–	...	1.1	1.6	4.3	22.5	9.6	25.9	11.4	56.6	76.0	163.8	167.3
	$'000	...	–	...	0.8	0.6	1.3	12.1	7.2	19.6	6.0	45.6	58.1	124.7	145.9
	$/Kg	...	–	...	0.73	0.38	0.30	0.54	0.75	0.76	0.53	0.81	0.76	0.76	0.87
Mexico	Tonnes	...	–	...	–	–	–	–	–	–	18.8	23.8	13.8	63.0	48.1
	$'000	...	–	...	–	–	–	–	–	–	4.5	4.1	2.1	26.6	29.5
	$/Kg	...	–	...	–	–	–	–	–	–	0.24	0.17	0.15	0.42	0.61
Canada	Tonnes	...	–	...	7.8	2.2	–	24.5	–	–	–	–	8.9	–	4.6
	$'000	...	–	...	1.5	0.5	–	3.7	–	–	–	–	1.7	–	1.7
	$/Kg	...	–	...	0.19	0.23	–	0.15	–	–	–	–	0.19	–	0.37
India	Tonnes	...	–	...	–	–	–	–	–	–	–	–	–	–	30.0
	$'000	...	–	...	–	–	–	–	–	–	–	–	–	–	38.2
	$/Kg	...	–	...	–	–	–	–	–	–	–	–	–	–	1.27
Indonesia	Tonnes	...	–	...	–	–	–	–	–	–	–	–	–	–	5.0
	$'000	...	–	...	–	–	–	–	–	–	–	–	–	–	3.9
	$/Kg	...	–	...	–	–	–	–	–	–	–	–	–	–	0.78
Other countries	Tonnes	...	–	...	0.9	2.0	0.5	3.2	–	2.4	4.5	2.2	0.6	1.7	2.9
	$'000	...	–	...	1.4	0.5	0.3	3.3	–	2.0	4.6	2.9	0.3	2.6	3.1

Source: USDA Foreign Agriculture Circular, Tea and Spices, various issues US Tariff Commission (1969)

Notes: (a) Market value in country of origin, exclusive of import duty (if any), freight and insurance charges
(b) Preliminary
– nil or negligible
. . . not available

Table 32

Parsley (manufactured): imports into the USA

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977[b]
TOTAL	Tonnes	26.1	50.5	21.5	64.0	22.2	24.3	16.9	5.3	36.7	34.0	18.8	19.3	29.6	11.9
	$'000[a]	21.4	50.6	19.8	64.5	26.9	26.2	17.9	4.8	33.1	38.3	22.1	21.6	32.5	19.0
	$/Kg	0.82	1.00	0.92	1.01	1.21	1.08	1.06	0.91	0.90	1.13	1.18	1.12	1.10	1.60
of which from:															
Hungary	Tonnes	–	–	1.0	3.1	2.5	11.7	5.9	2.5	22.0	31.5	18.5	11.3	21.0	–
	$'000	–	–	1.0	3.4	2.8	11.7	5.8	2.5	20.9	36.1	21.8	12.2	18.5	–
	$/Kg	–	–	1.00	1.10	1.12	1.00	0.98	1.00	0.95	1.15	1.18	1.08	0.88	–
Federal Republic of Germany	Tonnes	8.2	22.9	9.8	23.7	19.1	11.5	3.4	–	–	0.2	–	1.0	6.3	0.4
	$'000	8.7	28.9	11.8	29.1	23.8	13.6	4.4	–	–	0.4	–	4.9	12.0	0.7
	$/Kg	1.06	1.26	1.20	1.23	1.25	1.18	1.29	–	–	2.00	–	4.90	1.90	1.75
Dominican Republic	Tonnes	–	–	–	–	–	–	–	0.4	–	–	0.3	7.0	2.3	0.3
	$'000	–	–	–	–	–	–	–	0.3	–	–	0.3	4.5	2.0	0.4
	$/Kg	–	–	–	–	–	–	–	0.75	–	–	1.00	0.64	0.87	1.33
Spain	Tonnes	–	–	–	5.0	–	–	–	1.4	7.5	–	–	–	–	–
	$'000	–	–	–	2.4	–	–	–	0.6	7.8	–	–	–	–	–
	$/Kg	–	–	–	0.48	–	–	–	0.43	1.04	–	–	–	–	–
Netherlands	Tonnes	–	6.4	3.1	2.7	–	–	1.0	1.0	–	–	–	–	–	–
	$'000	–	7.5	2.4	2.9	–	–	1.3	1.4	–	–	–	–	–	–
	$/Kg	–	1.17	0.77	1.07	–	–	1.30	1.40	–	–	–	–	–	–
Belgium	Tonnes	2.0	8.8	4.1	21.5	0.6	–	4.2	–	–	–	–	–	–	–
	$'000	1.1	4.7	2.5	18.4	0.3	–	4.0	–	–	–	–	–	–	–
	$/Kg	0.55	0.53	0.61	0.86	0.50	–	0.95	–	–	–	–	–	–	–
Mexico	Tonnes	–	–	–	–	–	–	–	–	7.2	–	–	–	–	9.6
	$'000	–	–	–	–	–	–	–	–	4.4	–	–	–	–	17.0
	$/Kg	–	–	–	–	–	–	–	–	0.61	–	–	–	–	1.77
Yugoslavia	Tonnes	14.9	8.3	3.4	4.3	–	–	–	–	–	–	–	–	–	–
	$'000	10.9	4.7	2.0	3.5	–	–	–	–	–	–	–	–	–	–
	$/Kg	0.73	0.57	0.59	0.81	–	–	–	–	–	–	–	–	–	–
Other countries	Tonnes	1.0	4.1	0.1	3.7	–	1.1	2.4	–	–	2.3	–	–	–	1.6
	$'000	0.7	4.8	0.1	4.8	–	0.9	2.4	–	–	1.8	–	–	–	0.9

Source: USDA Foreign Agriculture Circular, Tea and Spices, various issues, US Tariff Commission (1969)

Notes: (a) Market value in country of origin, exclusive of import duty (if any), freight and insurance charges
(b) Preliminary
– nil or negligible

Chapter 13

Rosemary

INTRODUCTION

The herb rosemary comes from the plant *Rosmarinus officinalis* and belongs to the family Labiatae. The name rosemary comes from the Latin *rosmarinus*, meaning sea dew, and the plant grows wild by the sea throughout the Mediterranean region. The plant is a dwarf, dense, evergreen shrub, that grows up to 2 metres high and has highly branched (either erect or prostrate) linear leaves, axial inflorescences, and light blue flowers. The leaves are straight and fine, having the shape and appearance of pine needles, less than 25 mm long and dark green to brownish-green in colour. Rosemary prefers light, rather dry soil with adequate lime, and will grow in temperate climates, even in semi-shade, where yield is often increased by the taking of cuttings. Slow growing at first, rosemary can live to a great age, thirty years or more. Propagation is by seed or by semi-hardwood cuttings, the latter method being considered preferable. There are several varieties of rosemary, and it is important to choose those of high quality when undertaking production. Harvesting can take place throughout the year, when the leaves are picked from the branches and then dried either in thin layers in a shaded, well-ventilated spot or by artificial heat at a temperature not exceeding 40°C. Rosemary leaves have a tea-like fragrance, and when crushed they emit an agreeable, warm aromatic odour with a slight underlying camphoraceous note. The taste is aromatic, pungent, somewhat bitter and slightly camphoraceous.

USES AND QUALITIES

Most of the rosemary leaves collected are steam distilled to produce a pale-yellow essential oil, with yields of up to 1.0 per cent. The essential oil has an important role in perfumery and is widely used in hair shampoos, bath essences, deodorants, cosmetics, perfumes (especially eau de cologne) and insect repellents. However, the herb itself is almost entirely employed for culinary purposes, including the flavouring of meats, including sausages and lamb, sauces, bouillons, vegetable dishes, poultry and seafoods. It is also used as a garnish in salad dressings and in herb breads. Rosemary is a versatile herb, combining well with other spices and herbs, but its powerful flavour leads to restricted use in quantity terms, as well as to some sharply divided opinions as to its qualities. Thus whilst it is used discreetly in French, Spanish or Greek cooking, it is extensively used in Italian cooking. An oleoresin is also available, but this is only used in very small quantities by the food and meat industries. Rosemary is no longer important as a medicine.

Rosemary is available in the whole or ground form, but by far the largest proportion is sold in the whole form, since crushing causes rapid flavour loss. The quality characteristics are measured by the volatile oil, total and acid insoluble ash and moisture contents, and freedom from stems.

PRODUCTION AND TRADE

Rosemary grows wild and profusely throughout the Mediterranean area, production mainly taking place in Italy, Dalmatia and North Africa, whilst minor producers include France, Greece, Turkey, the Lebanon and Egypt. The only known producers outside the Mediterranean area are the USA and Mexico, but their production is very small and of almost no commercial significance. Since rosemary can be harvested for much of the year the major constraint on production is labour supply, which in turn is dependent on the price received for the herb and its oil. No estimates of production are available, but it is certain to be many thousands of tonnes because annual production of the essential oil alone is estimated at 400 tonnes.

The only trade data available dealing with the dried herb are US import statistics (see Table 33). From 1964 to 1969 annual imports averaged 210 tonnes, compared with 241 tonnes in the period 1970 – 77. The trend of imports during the 1960s was upwards, reaching a peak of 377 tonnes in 1968, but it fell to under 200 tonnes in 1970. During the 1970s imports rose rapidly to a peak of 353 tonnes in 1973 followed by a downward trend, reaching 165 tonnes in 1975. Data for 1976 and 1977 suggest that the trend is now upward. Several countries have exported rosemary to the USA, but Portugal has been the dominant supplier, providing in most years over half of US imports. Portugal, however, appears to produce only small quantities of rosemary oil compared with North Africa and Spain. Other suppliers have been Yugoslavia, France and Spain. Yugoslav exports to the USA rose rapidly to almost 100 tonnes per annum in the early 1970s and then fell drastically to 12 tonnes in 1974, since when, they have shown an upward trend. Imports from France and Spain have shown wide annual fluctuations. It is likely that French rosemary exports include a large proportion that has been re-routed through France. Minor exporters to the USA have included the Netherlands, West Germany, Israel, Belgium, the Lebanon, Mexico and Tunisia. The last supplied the USA for the first time in 1974 with 15 tonnes, which by 1975 had risen to 35 tonnes, representing 21 per cent of total US imports.

MARKETS

The **USA** is the market for which most information is available. A very small quantity is grown in the USA, mainly by Spice Islands Inc, but about 98 per cent of US consumption is imported. From the import statistics it can be seen that imports have fluctuated widely, and although there has been an upward trend in demand since 1976 the import levels have not yet surpassed those of the early 1970s. Some of these imports are used for the production of the essential oil and the oleoresin, but the quantities used for this purpose are thought to be very small. Opinions differ as to the major sectors in which rosemary is used, but all agree that although rosemary is popular among the Italian community, it is not a major item, and that demand is not expanding particularly quickly.

Although rosemary is consumed in all European countries, **Italy** is probably the major market for the herb, which is used extensively in Italian cooking. Unfortunately no Italian statistics of production or trade are available, and whether Italy imports or exports rosemary could not be ascertained. **France** also consumes large quantities of rosemary, estimated at 250 tonnes per annum. However, some of this is used for the production of rosemary oil, rather than for culinary purposes. Supplies are to a minor extent obtained from domestic sources, but are mainly imported from Tunisia, Morocco, Spain and Italy. Initially, contradictions among traders were apparent, as regards the size of the **West German** market, some stressing the herb's importance, others calling it a minor herb. It would seem that rosemary is in fact a large item of trade, but several herb packers, who deal mainly with the retail sector, consider it only a minor herb because its main uses are in the food and pharmaceutical industries. Although consumption estimates vary as a result of this, it would seem that the probable

figure is around 200 – 300 tonnes per annum. One source suggested that the pharmaceutical industry requires rosemary of a different quality, such as that obtained from Mexico. Both the food and pharmaceutical industries require a high volatile oil content, but are less concerned about appearance. Yugoslavia and Spain are the main suppliers, but the herb is also obtained from Morocco, Tunisia, Portugal and Algeria.

Other markets in Europe are smaller than those of Italy, France and West Germany. Consumption in the **Netherlands** is estimated at 30 – 50 tonnes per annum, with France supplying about 60 per cent of Dutch needs (perhaps through re-exports) and Spain 30 per cent, with small quantities from Egypt. Opinions differ as to the major usage sectors, one source suggesting that it is mainly used in the meat and sauce industry, another claiming that the retail sector is the main outlet. Consumption in the **United Kingdom** is around 25 tonnes, similar in size to the **Japanese** market. Finally, **Belgium** and **Switzerland** are small markets each with annual consumption of around 5 tonnes. According to one source, Switzerland sometimes imports rosemary in the green undried state for use in stuffing chicken.

PRICES

Rosemary is one of the least expensive of all herbs, because of the widely available supplies. Table 33 shows the average fob unit value of US imports, which have never exceeded $0.60 per Kg. Although the unit values have remained relatively low the trend has been continuously upwards, values rising three-fold from an average of $0.13 per Kg in 1964—66 to $0.44 per Kg in 1974—75. New York spot prices which are also contained in Table 33, show a similar upward trend, reaching a peak of $0.84 per Kg in 1978. In most years the unit values of imports from Portugal and Spain have been lower than those from France and Yugoslavia, reflecting the better quality of supplies from the latter two countries. Although prices will probably continue to increase in line with inflationary trends, it is doubtful whether rosemary prices will experience the wide annual price fluctuations so noticeable with other herbs, because of its widespread production and availability. Any shortages leading to price increases will quickly lead to more intensive collection and a stabilising of prices. Finally, rosemary oleoresin is relatively low in price compared with other oleoresins, being quoted in mid-1978 by one dealer at $16.50 per Kg.

PROSPECTS

The relatively low price of rosemary, combined with its widespread occurrence in Mediterranean countries, does not make it a good prospect for a new producer. Moreover, most rosemary grows wild and any new producer who had to establish and cultivate the crop would be at a disadvantage in cost terms. Although demand is increasing, the rate of growth is not as fast as that of most other herbs and any increased demand can almost certainly be met from existing sources.

Table 33

Rosemary: imports into the USA and spot prices

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976[a]	1977[a,b]	1978
TOTAL	Tonnes	119.8	153.8	159.7	241.9	377.3	209.2	192.1	209.4	335.3	353.2	243.6	165.4	189.3	237.8	...
	$'000[c]	16.0	19.0	23.0	38.7	56.5	44.1	41.8	57.2	85.2	124.2	104.5	75.2	87.1	132.8	
	$/Kg	0.13	0.12	0.15	0.16	0.15	0.21	0.22	0.27	0.25	0.35	0.43	0.45	0.46	0.56	
of which from:																
Portugal	Tonnes	...	...	...	161.7	211.3	78.1	118.6	99.7	147.1	174.5	153.5	69.7	113.0	59.3	
	$'000	...	...	...	20.8	35.5	12.9	20.0	22.2	39.3	60.8	60.4	24.6	43.2	31.8	
	$/Kg	...	...	...	0.13	0.17	0.17	0.17	0.22	0.27	0.35	0.39	0.35	0.38	0.54	
Yugoslavia	Tonnes	...	...	...	18.3	21.3	24.7	40.7	57.3	93.2	92.9	12.1	43.0	60.2	93.2	
	$'000	...	...	...	4.3	5.1	7.5	13.6	17.1	24.3	22.1	3.2	28.1	33.8	54.0	
	$/Kg	...	...	...	0.23	0.24	0.30	0.33	0.30	0.26	0.24	0.26	0.65	0.56	0.58	
France	Tonnes	...	...	...	34.0	65.4	58.0	29.8	32.5	19.7	37.2	42.8	9.8	13.3	35.8	
	$'000	...	...	...	7.7	4.6	16.1	7.7	8.7	5.4	22.5	26.3	6.5	6.9	20.1	
	$/Kg	...	...	...	0.23	0.07	0.28	0.26	0.27	0.27	0.60	0.61	0.66	0.52	0.56	
Spain	Tonnes	...	...	...	19.9	79.3	48.4	3.0	9.9	75.3	48.4	19.6	7.5	2.5	49.0	
	$'000	...	...	...	3.3	11.3	7.3	0.5	2.6	15.9	16.8	7.7	3.8	1.3	25.4	
	$/Kg	...	...	...	0.17	0.14	0.15	0.17	0.26	0.21	0.35	0.39	0.51	0.52	0.52	
Tunisia	Tonnes	...	...	...	–	–	–	–	–	–	–	15.0	35.0	–	–	
	$'000	...	...	...	–	–	–	–	–	–	–	4.8	11.9	–	–	
	$/Kg	...	...	...	–	–	–	–	–	–	–	0.32	0.34	–	–	
Other countries	Tonnes	...	...	...	8.0	–	–	–	10.0	–	0.2	0.6	0.4	0.3	0.5	
	$'000	...	...	...	2.6	–	0.3	–	6.6	0.3	2.0	2.1	0.3	1.9	1.5	
Approximate New York spot prices as of early March ($/Kg)																
Portuguese		...	...	...	...	...	...	0.26	0.35	0.49	0.53	0.64	0.60	0.64	...	0.84

Source: USDA Foreign Agriculture Circular, Tea and Spices, various issues US Tariff Commission (1969)

Notes: (a) In 1976 and 1977 the USA imported 1.6 tonnes and 1.3 tonnes of processed rosemary, valued at US$9 000 and $10 500, respectively
(b) Preliminary
(c) Market value in country of origin, exclusive of import duty (if any), freight and insurance charges
– nil or negligible
... not available

Chapter 14

Sage

INTRODUCTION

There are many species of *Salvia* (a member of the Labiatae family), which are generally known as sage. The sage herb most commonly found in commerce is *Salvia officinalis*, produced mainly in Yugoslavia and Albania and known as Dalmatian sage. Smaller quantities are also produced in Turkey, Italy, Greece, Malta, Cyprus, France, Germany, the UK and Caucasus region of the USSR, Israel, Argentina, Mexico, Canada and the USA. Although derived from the same plant botanically, there are numerous local variations since sage is very susceptible to climatic and soil conditions. Thus variations in soil fertility, moisture, temperature, wind, rain and sunshine can lead to considerable variation in character, even if grown in the same field using identical harvesting and processing techniques. For example, whilst Yugoslav and Albanian sage are comparable in essential oil levels, there are certain differences in flavour characteristics, giving Yugoslav sage its smoother, more fully rounded flavour notes.

S. officinalis is a perennial herb, with a long, spindle-shaped root and an erect, woody stalk with straight branches. It grows to approximately 60 cm in height and has pale blue or purplish flowers. The leaves are elongated and spear-shaped, with a soft velvety texture, averaging about 75 mm in length. Before drying, the leaves are greyish-green in colour, with a predominance of grey on the underside, but when dried they turn a silvery grey. The leaves possess a strong, fragrant and aromatic odour, relatively free of any camphoraceous note, and free of any objectionable terebinthic odour. Sage can be grown from seeds, but for commercial propagation cuttings are used. The first year's crop from a planting is usually light, but from the second and subsequent harvests an annual production of 275–375 Kg per hectare of dried sage can be expected from two cuttings (Williams, 1960). Harvesting should be undertaken just before flowering, and is usually carried out by hand or by cutting of the top 75–125 mm with a mower. Hand picking of the leaves produces a higher grade product. Dehydration by modern methods provides the most satisfactory marketable product, but sage can be dried in the shade although this tends to result in a darker coloured product which has a reduced market value. The moisture should be reduced to approximately 12 per cent, and one source has suggested that cultivated sage contains more sand than wild-growing sage and must therefore be thoroughly washed before drying (Hanson and Hocking, 1957). Since sage loses flavour with age and exposure to air, it should be baled and marketed as soon as possible.

Dalmatian sage is also known as true sage, garden sage and red sage, the latter term being used in England and referring to the occasional colour of the leaves. English sage, although from *S. officinalis*, has a milder and more fragrant flavour and is not as assertive in a blended seasoning as Dalmatian sage. The characteristic odour and flavour quality of Dalmatian sage is determined by the thujone content, which is much less apparent in English sage. During the past two decades, Cyprus sage herb has become commercially available. This has a

mildly aromatic flavour and aroma with a predominant camphoraceous note, quite different from Dalmatian and English sage.

Apart from different varieties of sage there are other species of *Salvia*, the leaves of which are used for flavouring but to a smaller extent than *S. officinalis*. Spanish sage *S. lavandulaefolia* is a wild perennial herb indigenous to Spain, found especially in the provinces of Murcia, Almeria and Granada, and also in the south-western margin of France, where it thrives at up to 1 500 m above sea-level. Its leaves are smoother and smaller than *S. officinalis*, being 25—38 mm long and 6—13 mm wide. Spanish sage is also easily distinguished by its strong camphoraceous note reminiscent of rosemary and spike lavender, and because of this it is mainly used in perfumery for the scenting of soaps and other technical products, and finds limited use in food flavourings. *S. triloba*, commonly known as Greek sage, is also a perennial herb with thicker, larger and shorter leaves than *S. officinalis*. It has a harsh odour reminiscent of rosemary, spike and camphor. Although it is grown throughout the Mediterranean region the major producing areas are Turkey and Greece. The dried herb and oil find flavour applications similar to those of Dalmatian sage, but in smaller quantities because of its inferior flavour. Clary sage (*S. sclarea*) is a biennial or perennial plant about 1.5 m high, with a taproot, hairy erect stalk and wide, woolly oval leaves. It is cultivated for extractive purposes in the Mediterranean basin, central Europe and the USSR. The large leaves are strongly aromatic and can be used either fresh or dried as a flavouring, but they do not appear to be in great use today. Other species of sage that are used occasionally for culinary purposes include *S. pratensis* (meadow sage), *S. rutilans* (pineapple sage), *S. maurorum* (ash-leaved sage from Morocco) and *S. horminum*. Finally, there are many plants throughout the world that are called sage, such as 'sagebrush' in the USA and 'wild sage' of South Africa, but these are not members of the true sage family.

USES AND QUALITIES

Although sage has had many uses in the past, it is now almost entirely utilised in the food industry as a flavouring agent and condiment. Today sage is probably the world's most popular flavouring and seasoning herb, large quantities being used in commercial meat packing and processing, especially in pork, sausages and poultry seasonings. It is also used to flavour cheese, baked fish, salad dressings, chowders and soups. Sage is also a most important ingredient of 'mixed herbs', as well as being used in herbal teas and for medicinial purposes.

Sage oils, of varying qualities, have long been known and used in flavouring condiments, cured meats, liqueurs and bitters, as well as in perfumery formulations. In the past decade food manufacturers have also been using sage oleoresin in condiment and meat flavouring, especially in pork sausages and poultry stuffings as a replacement for the dried herb, and sage is the source of probably the second most important herb oleoresin after celery seed.

Dried sage is available in several forms: whole leaf, which has been cleaned and prepared for sale, but not cut or otherwise processed; 'chopped' sage which has been cut, but not ground, into smaller sizes of usually 3—6 mm; rubbed sage, a traditional term for sage which has been slightly ground and only coarsely sieved; and ground sage, which has been further ground and finely sieved to a fine powder, in contrast to the fluffy consistency of rubbed sage. Rubbed and ground sage are very similar because the high essential oil content of the fluffy leaves prevents the ground product from compacting but, nevertheless, the finer the grinding, the more easily will the sage blend into the food and not be visually apparent in the final product. Although rubbed and ground sage are quickly absorbed into the final product, many sausage manufacturers prefer the less processed rubbed sage, arguing that it helps to preserve flavour longer. Cut sage is used when a manufacturer wants the sage to be seen in the final product. Of the four types of sage, rubbed sage is the most commonly used, but it must be

recognised that there are no standardised specifications for the above terms and the herb processor tends to produce a product in line with a user's specific requirements (American Spice Trade Association, 1970).

In general, buyers of sage look for a silvery grey colour, fresh and unfaded appearance, along with a highly aromatic aroma and a strong, warm, slightly bitter taste. Quality characteristics are measured by the volatile oil, total and acid insoluble ash and moisture contents, and freedom from stems and other impurities. Geographical source is important in evaluating flavour, type and strength; and one trade source suggested a preference for the wild Dalmatian product, rather than the cultivated one.

PRODUCTION AND TRADE

Salvia officinalis and other *Salvia* species grow wild or are cultivated on dry sunny slopes and limestone rocks throughout southern Europe, but published information on both production and trade is extremely limited. Even where trade data are available, the level of domestic consumption is unknown, thus making production estimates difficult. The most important commercial producer of the dried leaf and of sage oil is Yugoslavia, where sage, both wild and cultivated, is grown in many parts of the country, but particularly on the rocky, sunny hillsides of the Dalmatian islands and the adjacent Adriatic mainland coasts; for example, the San Martino and Dubrovnik districts are important producing areas. The best type grows on the islands of Krk and Cres, near Rijeka, where the surrounding area is known as the 'Sage region'. Yugoslavia is not only an important producer of dried sage and sage oil, but also of sage honey, the nectar from the plant being gathered by bees during the flowering season.

Available data would suggest that Yugoslav sage production is of the order of 1 000 tonnes per annum. As Table 34 shows, Yugoslav sage exports more than doubled from 1966 to 1973. Since the peak level of 1973, when 915 tonnes were exported, there has been a reduction in exports, suggesting a fall in production. The two major reasons for this are believed to be the perennial problem of labour shortages for herb collection arising from the existence of more attractive remuneration in towns and industry, particularly outside Yugoslavia, and also a series of poor harvests resulting from drought problems throughout the Mediterranean region. To some extent, Yugoslav exports are thought to be supplemented by Yugoslav re-exports of Albanian sage.

The USA has been the major importer of Yugoslav sage, taking on average 70 per cent of Yugoslav imports during the period 1966–75 (see Table 34). Yugoslav traders have an exclusive contract with one New York broker covering all herbs sold in the USA. This broker in turn has a similar arrangement with a New York dealer, who is also the exclusive seller of Albanian sage. Attempts to buy directly from source have been unsuccessful, and most of the major processors and grinders appeared to be content with the present situation. The UK is the second major importer of Yugoslav sage, annual exports to that destination averaging 102 tonnes in the decade 1966–75. No discernible trend is apparent, exports to the UK having shown wide annual fluctuations ranging from 59 tonnes in 1971 and 1975, to 182 tonnes in 1972, and 160 tonnes in 1973. Sizable quantities have also been exported to Italy (perhaps for re-export), Canada and West Germany, whilst small quantities have been shipped to Austria, Belgium, Switzerland, Australia, France, Brazil, Argentina, Japan and the Netherlands.

Turkey is the only other sage exporter providing trade statistics, and these are shown in Table 35. During the period 1967–75 Turkish exports averaged 162 tonnes per annum, with a low of 74 tonnes in 1968 and a peak of 252 tonnes in 1970. Exports have shown wide annual fluctuations. The major markets for Turkish sage are the USA, France, Japan and Italy. Smaller quantities are also exported to West Germany, Canada, the Netherlands, Belgium/Luxembourg, Switzerland, the UK, Cyprus and Spain. Although Italy grows sage, the evidence

from the Turkish data would suggest that it is insufficient to meet her requirements.

The USA provides the only data on sage imports, which are shown in Table 36. Annual imports averaged 1 161 tonnes for the period 1964—77. The trend in imports has been upwards, reaching a peak of 1 611 tonnes in 1973, since when the amount imported has returned to the levels of the early 1970s. Yugoslavia and Albania dominate the USA's supply sources, supplying over 75 per cent of her needs. Until the early 1970s imports from Yugoslavia were greater than those from Albania, and it was only in 1972 that the Albanian imports exceeded those from Yugoslavia for the first time. In 1973 and 1974 Yugoslavia was again the dominant supplier, but in 1975, 1976 and 1977 supplies were once again greater from Albania. Supplies from other sources, namely Italy, Greece and Turkey, have been minor compared with those from Albania and Yugoslavia. Nevertheless, Turkish supplies have shown an upward trend, reaching a peak of 70 tonnes in 1976, but falling to 28 tonnes in 1977.

The USA produces some sage in California, Washington and Oregon states, but this is negligible in comparison with imports. Domestic production was significant during the Second World War, but declined when the superior flavoured European varieties again became available and it is currently estimated at around 100 tonnes. The sage bush of Western USA has a turpentine flavour and is not fit for food use. Various *Salvia* species are collected in Greece, one source suggesting that Greece exports about 200—300 tonnes of sage herb per annum to different countries in Europe and the USA (Skrubis, 1972). The UK also grows some sage, but this is entirely for domestic consumption. From the available trade statistics and from discussions with the trade it seems that several other countries grow or export sage, including Spain, Portugal, Cyprus, USSR, Israel, Italy, Crete, Mexico, Canada, Nicaragua, Algeria and Romania, but their production and exports appear to be relatively minor when compared with those of Yugoslavia and Albania.

According to some sources, adulteration of *S. officinalis* from Dalmatia occurs, but it is now less common than previously. Adulterants include sage stems along with poorer quality sage of this species, as well as Spanish and Greek sages. Most buyers object to adulterants and hence the preference to purchase from a known supplier of Dalmatian sage.

Sage is the source of probably the second most important herb oleoresin, and the USA is the major producer, several companies extracting the oleoresin for use mainly in pork sausages and poultry stuffings. Production is also undertaken in the UK, although on a much smaller scale.

MARKETS

From the Yugoslav and Turkish trade statistics it is apparent that many countries import significant quantities of sage. The USA is by far the major consumer, followed probably by the UK, Italy, Canada, France and Japan.

The United States of America

From the production and trade data discussed in the previous section it was seen that US consumption of sage is in the region of 1 500 tonnes per annum, the vast proportion of which is imported from Yugoslavia and Albania. Yugoslav exports are shipped to the USA in tightly compressed bales of approximately 50 Kg each, whilst Albanian sage is shipped in loose semi-compressed bales. Its dominant use is in poultry stuffing and sausage seasoning, and therefore mainly in the meat industry. Whilst the latter use is essentially industrial, poultry seasoning is primarily retailed, although in the last five years there has been a movement towards industrially prepared stuffing. According to one reliable source, the market for sage is growing because of the increased use of stuffing mixes, but

the dried herb is facing intense competition from the oleoresin and the essential oil in its industrial sector uses. The demand for sage is seasonal, most poultry stuffing being consumed in November and December, whilst sausages are consumed mainly in the winter months. Until recently demand was also regional, producers in the south and mid-west regions placing greater emphasis on sage in their sausages, but in the last decade other regions have also become substantial sage users.

The United Kingdom

Sage, along with mint, is the major herb consumed in the UK, with consumption of approximately 250—300 tonnes per annum. Sage was one of the herbs that continued to be used during the decline of herb usage in English cooking. In a recent survey of UK housewives nearly 60 per cent of those surveyed had some sage in store, and it was regarded as the most important herb. It is mainly used in sage and onion stuffing for poultry and with pork, but is not as widely used in sausages as in the USA. One major UK importer said that sage from various sources was often blended. A large proportion of UK consumption is produced domestically, and there is certainly a preference for the mild English sage, rather than the more pungent imported types.

Other markets

The Federal Republic of Germany (West Germany). Estimates of sage usage in West Germany suggest that it is a relatively small item with an annual consumption of about 50—75 tonnes. Its major uses appear to be for medicinal purposes, in herbal teas, and for stuffings. Demand is partially satisfied by local production in southern Germany, together with imports from Yugoslavia and Turkey. Yugoslav sage is the only one acceptable to the National Pharmacopoeia. Demand was thought to be increasing relatively slowly, and no-one expressed concern with regard to future supplies.

France. In French cooking sage is used occasionally, but only rarely as a dominant flavour, in contrast with the UK and the USA, and hence consumption is not particularly great. One major French importer purchased about 150 tonnes per annum, mainly from Italy, Yugoslavia and the USSR, as well as from local sources, and considered that demand was steadily increasing. Another major dealer, however, listed Turkey and Greece as the major sources of French sage.

The Netherlands. Imports are mainly of Greek sage, but supplies are also obtained from Spain, Turkey and Yugoslavia. The market is growing and is currently estimated at 20—30 tonnes, most of which is consumed in the retail sector.

Italy. In Italy sage is very highly regarded and consumption, mainly of domestically-produced sage, is quite large. According to one source, Italy imports sage from Turkey and Dalmatia, cleans and crushes it and then re-exports it to the USA and Europe.

Switzerland. A major importer considered sage a minor item, with only a few thousand kilograms imported each year, mainly from Greece, and used mainly in the meat industry.

Belgium. The Belgian market is also very small with imports of less than 5 tonnes annually.

Japan. The demand for sage is growing in Japan, where annual consumption is currently estimated at 20—30 tonnes, the majority of which is used for industrial purposes. The major source is Yugoslavia, but France and Turkey also contribute.

PRICES

The greater demand for, and quality of, Yugoslav sage is reflected in the price differential for this herb as shown in Table 36. The fob unit value of Yugoslav sage imports to the USA was fairly stable during the period 1964—69, but then rose continuously to 1977 when a peak of $1.49 per Kg was reached. The unit value of total Yugoslav sage exports, shown in Table 34, shows an almost identical trend. On the other hand, the value of Albanian sage exports to the USA, whilst showing a similar rising trend during the 1970s, has been approximately 30—50 per cent below the unit value of Yugoslav exports, with a peak of $0.96 per Kg in 1977. However, the approximate New York spot prices of Albanian sage, also shown in Table 36, suggests that cif prices are almost double fob prices, a peak of $1.92 per Kg being reached in 1978.

In general, Yugoslav sage prices have been consistently above those of Italian, Turkish and Greek sage. In the mid-1970s Italian and Greek prices showed a rapid upward trend and on occasions surpassed the unit value of Yugoslav sage, but this is almost certainly accounted for by the much smaller volume of Greek and Italian exports (see Table 36). Thus one can conclude that of the several other sages that enter trade none is considered to be on a par with Dalmatian sage in terms of flavour because of their harsher notes, and this is duly reflected in the prices.

Sage oleoresin was listed by one US dealer in mid-1978 as $28.50 per Kg.

PROSPECTS

While the propects for sage appear to be very good, the extent to which a new producer can break into the market is very much dependent upon his ability to provide a close substitute for existing supplies in aroma and flavour terms. The production of Dalmatian sage has attracted several growers in the past, but each has failed to provide a satisfactory substitute for existing Yugoslav and Albanian supplies, and as a result they have had to accept a price considerably lower than that received by Dalmatian producers. Moreover, establishing a crop of sage is relatively expensive, but since it is a perennial it can produce for 5 to 10 years, although some producers tend to replant at shorter intervals.

Propects for sage oleoresin are probably as good as those for the dried herb, but it would be totally unrealistic, for both economic and technical reasons, for a new producer to undertake such production.

Table 34

Sage: exports from Yugoslavia

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
TOTALS	Tonnes	423.3	601.3	781.9	829.0	838.3	817.3	905.4	915.2	673.9	621.3
	$'000	247.2	352.3	471.7	501.4	552.5	622.0	845.1	1015.2	921.8	795.6
	$/Kg	0.58	0.59	0.60	0.60	0.66	0.76	0.93	1.11	1.37	1.28
of which to:											
Austria	Tonnes	4.9	5.8	9.6	10.2	5.8	2.6	2.2	3.0	0.8	–
	$'000	2.2	2.6	4.4	4.9	3.4	2.4	2.3	3.5	1.0	–
	$/Kg	0.44	0.45	0.46	0.48	0.59	0.92	1.03	1.15	1.20	–
Italy	Tonnes	–	50.0	31.0	80.0	110.0	90.0	81.0	–	10.0	10.0
	$'000	–	21.7	13.5	34.8	47.4	49.1	55.7	–	12.3	2.7
	$/Kg	–	0.43	0.43	0.44	0.43	0.55	0.69	–	1.23	0.27
Federal Republic of Germany	Tonnes	12.2	11.7	18.4	10.7	13.5	27.5	68.3	62.0	4.5	35.4
	$'000	5.5	5.2	8.5	4.8	7.9	19.4	60.2	59.4	4.8	32.6
	$'Kg	0.45	0.44	0.46	0.45	0.59	0.71	0.88	0.96	1.06	0.92
UK	Tonnes	81.0	104.9	117.5	95.0	69.5	58.5	181.5	160.0	92.5	59.0
	$'000	31.0	38.9	43.9	36.4	34.5	35.4	145.3	135.8	95.0	53.9
	$/Kg	0.38	0.37	0.37	0.38	0.50	0.60	0.80	0.85	1.03	0.91
Canada	Tonnes	–	16.0	17.0	25.5	35.0	45.0	54.5	41.0	74.0	83.0
	$'000	–	7.8	8.4	12.7	18.6	38.5	50.0	48.4	103.4	104.9
	$/Kg	–	0.49	0.49	0.50	0.53	0.86	0.92	1.18	1.40	1.26
USA	Tonnes	325.3	410.0	587.5	600.0	600.0	591.4	516.5	642.5	487.5	430.2
	$'000	208.6	274.9	392.7	404.4	438.2	475.8	530.5	765.1	697.9	595.8
	$/Kg	0.64	0.67	0.67	0.67	0.73	0.80	1.03	1.19	1.43	1.38
Other countries	$'000	–	2.9	0.9	7.6	4.5	2.3	1.4	6.7	4.6	3.7
	$'000	–	1.2	0.3	3.4	2.5	1.4	1.1	3.0	7.4	5.7

Source: Statistics of Foreign Trade of the SFR Yugoslavia

Note: – nil or negligible

Table 35

Sage: exports from Turkey

		1967	1968	1969	1970	1971	1972	1973	1974	1975
TOTALS	Tonnes	95.5	74.4	180.7	251.7	153.8	166.2	193.6	205.4	135.8
	$'000	16.1	16.5	35.5	44.8	35.1	46.3	96.0	122.6	78.8
	$/Kg	0.17	0.22	0.20	0.18	0.23	0.28	0.50	0.60	0.58
of which to:										
France	Tonnes	5.2	9.8	49.5	66.1	28.2	44.6	43.6	65.6	40.0
	$'000	1.0	1.8	8.9	10.2	5.8	11.7	19.9	37.5	21.1
	$/Kg	0.19	0.18	0.18	0.15	0.21	0.26	0.46	0.57	0.53
Federal Republic of Germany	Tonnes	12.5	12.8	32.3	35.8	19.5	17.4	1.3	12.0	–
	$'000	2.2	4.1	5.9	5.4	4.5	4.7	0.3	6.7	–
	$/Kg	0.18	0.32	0.18	0.15	0.23	0.27	0.26	0.56	–
Italy	Tonnes	26.0	18.1	27.2	47.0	31.0	26.0	19.7	49.9	9.7
	$'000	3.8	3.6	5.6	7.7	7.2	6.5	10.5	28.1	5.4
	$/Kg	0.15	0.20	0.21	0.16	0.23	0.25	0.53	0.56	0.55
Japan	Tonnes	16.7	28.0	11.0	32.3	28.8	15.0	65.0	10.0	20.0
	$'000	3.5	5.7	2.9	7.5	7.0	4.5	31.1	6.2	12.3
	$/Kg	0.21	0.21	0.23	0.23	0.24	0.30	0.48	0.62	0.61
USA	Tonnes	30.7	–	44.5	47.5	30.0	43.5	35.2	36.1	57.0
	$'000	4.7	–	8.9	10.2	6.9	13.7	19.2	24.6	34.9
	$/Kg	0.15	–	0.20	0.21	0.23	0.31	0.55	0.68	0.61
Canada	Tonnes	–	2.5	5.5	0.5	4.5	3.0	1.0	11.3	4.0
	$'000	–	0.6	1.3	0.2	1.3	0.9	0.5	7.1	2.3
	$/Kg	–	0.24	0.23	0.32	0.28	0.29	0.46	0.63	0.58
Netherlands	Tonnes	–	2.2	2.1	0.5	2.8	1.5	3.4	6.5	3.5
	$'000	–	0.5	0.5	0.1	0.6	0.4	1.2	3.8	1.9
	$/Kg	–	0.21	0.22	0.20	0.22	0.27	0.34	0.58	0.55
Belgium/Luxembourg	Tonnes	1.5	0.9	1.5	4.0	2.0	3.5	–	2.5	1.0
	$'000	0.4	0.2	0.3	0.5	0.5	1.1	–	0.9	0.6
	$/Kg	0.24	0.20	0.23	0.13	0.24	0.31	–	0.34	0.56
Switzerland	Tonnes	1.0	–	1.0	2.0	–	4.7	1.1	5.5	0.6
	$'000	0.2	–	0.2	0.4	–	1.2	0.5	3.3	0.3
	$/Kg	0.23	–	0.21	0.20	–	0.26	0.45	0.61	0.55
UK	Tonnes	–	–	–	8.1	4.0	4.0	20.0	–	–
	$'000	–	–	–	1.3	0.8	1.0	10.2	–	–
	$/Kg	–	–	–	0.16	0.21	0.24	0.51	–	–
Other countries	Tonnes	1.9	0.1	6.1	8.0	3.0	3.0	3.3	6.0	–
	$'000	0.3	–	1.0	1.3	0.5	0.6	2.6	4.4	–

Source: Annual Foreign Trade Statistics, Turkey

Note: – nil or negligible

Table 36

Sage (not ground): imports into the USA and spot prices

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977[a,b]	1978
TOTAL	Tonnes	648.8	1 070.3	670.9	993.8	1 218.8	1 171.5	1 059.5	1 274.6	1 473.8	1 611.3	1 290.4	1 065.2	1 305.9	1 393.4	...
	$'000[c]	319.1	597.3	351.9	511.2	674.4	634.1	594.1	782.5	1 127.0	1 406.9	1 397.2	1 231.4	1 372.7	1 619.5	...
	$/Kg	0.49	0.56	0.52	0.51	0.55	0.54	0.56	0.61	0.76	0.87	1.08	1.16	1.05	1.16	...
of which from:–																
Federal Republic of Germany	Tonnes	9.8	–	–	–	–	–	–	47.4	75.3	4.9	9.5	–	–	4.9	...
	$'000	4.1	–	–	–	–	–	–	40.0	62.8	5.1	12.7	–	–	8.6	...
	$/Kg	0.42	–	–	–	–	–	–	0.84	0.83	1.05	1.33	–	–	1.76	...
Italy	Tonnes	113.5	127.5	11.9	72.1	44.2	76.8	29.5	27.8	42.4	23.2	45.8	10.0	21.0	25.0	...
	$'000	45.4	53.3	4.4	32.5	23.4	33.9	15.2	20.0	46.8	18.5	66.0	12.5	29.1	25.8	...
	$/Kg	0.40	0.42	0.37	0.45	0.53	0.44	0.52	0.72	1.10	0.80	1.44	1.24	1.39	1.03	...
Yugoslavia	Tonnes	291.1	689.7	371.6	519.5	732.1	655.8	576.8	585.2	523.5	818.3	978.1	480.1	478.4	443.0	...
	$'000	185.9	448.3	247.0	344.5	484.2	453.9	426.7	500.8	532.5	924.7	1 104.9	682.3	621.0	659.4	...
	$/Kg	0.64	0.65	0.66	0.66	0.66	0.69	0.74	0.86	1.02	1.13	1.13	1.42	1.30	1.49	...
Albania	Tonnes	205.3	211.5	268.3	326.3	398.2	392.0	394.1	542.5	739.7	675.1	184.6	504.9	730.8	866.8	...
	$'000	75.4	83.5	96.2	118.1	150.2	133.3	132.3	194.2	436.9	401.9	129.9	480.9	667.0	829.1	...
	$/Kg	0.37	0.39	0.36	0.36	0.38	0.34	0.34	0.36	0.59	0.60	0.70	0.95	0.91	0.96	...
Greece	Tonnes	7.2	5.3	2.2	1.0	–	1.7	5.0	13.0	28.6	39.0	16.7	4.8	5.6	0.1	...
	$'000	1.8	2.4	1.4	0.4	–	1.8	4.4	7.2	15.1	19.7	17.9	8.7	6.5	0.3	...
	$/Kg	0.25	0.46	0.67	0.38	–	1.07	0.87	0.56	0.53	0.50	1.08	1.83	1.16	3.00	...
Turkey	Tonnes	9.9	10.0	16.9	44.8	–	44.0	47.7	38.4	37.8	40.9	25.9	63.0	70.0	27.9	...
	$'000	1.2	1.1	2.9	8.7	–	10.2	10.7	10.6	11.9	21.7	18.8	41.9	41.8	24.6	...
	$/Kg	0.12	0.11	0.17	0.19	–	0.23	0.22	0.28	0.31	0.53	0.73	0.66	0.60	0.88	...
Algeria	Tonnes	–	–	–	–	–	–	–	–	–	–	–	–	–	18.7	...
	$'000	–	–	–	–	–	–	–	–	–	–	–	–	–	12.6	...
	$/Kg	–	–	–	–	–	–	–	–	–	–	–	–	–	0.67	...
Canada	Tonnes	–	–	–	–	–	–	–	–	10.9	9.8	25.1	–	–	–	...
	$'000	–	–	–	–	–	–	–	–	12.4	12.9	34.1	–	–	–	...
	$/Kg	–	–	–	–	–	–	–	–	1.14	1.32	1.36	–	–	–	...

Table 36—*continued*

Sage (not ground): imports into the USA and spot prices

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977[a,b]	1978
Mexico	Tonnes	—	—	—	—	—	—	—	—	—	—	4.4	2.4	—	5.4	...
	$'000	—	—	—	—	—	—	—	—	—	—	12.2	4.8	—	14.2	...
	$/Kg	—	—	—	—	—	—	—	—	—	—	2.80	2.03	—	2.63	...
Other countries	Tonnes	12.0	26.3	—	30.1	44.3	1.2	6.4	20.3	15.6	0.1	0.3	—	0.1	1.6	...
	$'000	5.3	8.7	—	7.0	16.6	1.0	4.8	9.7	8.6	2.4	0.7	0.3	7.3	44.9	...
Approximate New York spot prices as of early March ($/Kg)																
Albanian		...	...	0.62	0.66	0.66	0.71	0.77	0.97	1.32	1.32	1.32	1.76	1.72	1.68	1.92

Source: USDA, Foreign Agriculture Circular, Tea and Spices, various issues

Notes: (a) The USA has imported small quantities of ground or rubbed sage (1.6 tonnes in 1977 from Greece and Yugoslavia), but these are not included
(b) Preliminary
(c) Market value in country of origin, exclusive of import duty (if any), freight and insurance charges
— nil or negligible
. . . not available

Chapter 15

Savory

INTRODUCTION

There are a number of species of savory, but only two, the annual *Satureia hortensis* (summer savory) and the perennial *S. montana,* are generally traded. However, in Spain another species, *S. thymba,* which is very similar in flavour to thyme, is used for culinary purposes, and it is more than likely that other species of savory are used for local consumption. Summer savory is an erect, bushy, annual, much branched but compact plant which may reach about 45 cm in height. The stems are hairy, and the pale brownish-green leaves seldom exceed 10 mm in length. Summer savory and winter savory closely resemble each other, but the latter is a hardy woody perennial.

The several types of savory all have a distinguishing peppery taste; in Germany one of the herb's everyday names is 'Pfefferkraut' (pepper herb), whilst in Provence it is known as 'poivre d'âne'. The flavour, although somewhat similar to thyme, is more bitter and quite distinctive. Although summer savory and winter savory have essentially similar flavours, the latter's flavour is regarded as somewhat inferior and this accounts for its more limited use as a culinary herb.

All savories grow best in well-drained, light soil in a sunny position. Propagation is by seed, sown in early spring, and harvesting should take place just before flowering when the flavour is at its best. The whole plant is cut at ground level, and usually dried in the shade and stored in sealed containers to maintain colour and avoid loss of the essential oil. The herb dries well and keeps its flavour.

USES AND QUALITIES

The highly aromatic leaves and tender tips can be used, either fresh or dried, for flavouring and in small quantities for medicinal purposes. The main traditional culinary use is as a flavouring for vegetables, particularly beans and peas, especially in France, Switzerland and Germany. Savory is often known in Germany as 'Bohnen kraut', and in the Netherlands as 'boonen kniid', both meaning bean herb. Savory also blends well with other herbs and is used in mixtures, including 'bouquet garni' and 'fines herbes'. It is also used alone or in combination with other herbs, to flavour sausages, stuffings, poultry, soups, eggs, salami, herb bread, rice, fish, salads, sauces and stews. In France it is also used industrially in the manufacture of white 'bamon' cheese. Moreover, it is sometimes used as a substitute for parsley in garnishing. Winter savory is used in France with trout, and in the Netherlands and Belgium it is reported as being used for pickling and marinating. The tincture and the dried product are also used in the making of liqueurs (vermouths and bitters), especially in Italy.

Essential oils are obtained by steam distillation from both summer and winter savory, and small quantities of both are used in the food industry to flavour

sauces, soups and prepared meats, and also in perfumery. A savory oleoresin is occasionally used, but in commercially insignificant quantities.

For use as a herb only the dried leaves and flowering tips are used, but when employed in the fresh state the whole aerial part of the plant is utilised. The herb is available in the whole or ground form.

PRODUCTION AND TRADE

Only small quantities of savory are traded internationally, and except for US imports there are no trade or production statistics available. US trade statistics show that Yugoslavia, Spain and France are the major sources of US supplies, and certainly southern Europe and the Mediterranean region are the main producing areas, although other sources have suggested that small quantities have been produced in many temperate countries, including Western USA, Canada, England, Yugoslavia, Belgium, Germany, Morocco, Hungary, Austria, Bulgaria, Italy, the USSR, South Africa and the Lebanon. No trade source was able to estimate production levels, but it is agreed that production and trade are very small and that in no country is savory an important item in the herb trade. This is supported by the fact that no country separately specifies its exports of savory. The information on the species of savory grown and exported is also limited, several sources believing that summer savory dominates production of and trade in the product, whilst others suggested that both wild winter savory and cultivated summer savory are grown in France, and that wild winter savory is the most common type in Spain, Yugoslavia, Morocco and central Europe.

The statistics of US imports of savory would suggest that two major sources, Yugoslavia and France, are the dominant suppliers of traded savory (see Table 37). Since 1970 the trend of US imports of Yugoslav savory has been upwards, averaging 44 tonnes per annum during the period 1970–77, compared with average annual imports from all sources into the USA of 71 tonnes. Since 1970 US imports from France have fallen, reaching a low of nearly 6 tonnes in 1975, with an annual average of 24 tonnes during the period 1970–77. The fall in US imports from France is probably a result of reduced domestic production and the need to satisfy a growing European market. The USA has also imported small quantities of savory from Spain, the Lebanon, the Netherlands and Belgium.

MARKETS

Although savory consumption is relatively small and insignificant compared with that of many other herbs and spices, it is discussed in some detail because of reported shortages, particularly in Western Europe. However, the relatively small quantities of internationally traded savory have led to a dearth of information on market sizes and trends.

Since domestic production of savory in the **USA** is reported as extremely small, it can be assumed that imports satisfy nearly all of the demand. In recent years no discernible trend in consumption has been apparent, but it would seem that the US market consumes 70–90 tonnes per annum.

Several sources in **France** complained about supply shortages which had been further exascerbated by the 1976 drought. France is the major market for savory, one source suggesting an annual consumption of around 150 tonnes, but it could well be that the true figure is less than this on account of re-exports. Local production in Provence supplies much of the market, although imports from Morocco, Italy, Yugoslavia, Bulgaria and Hungary have also been reported.

West Germany produces some savory and also imports from East Germany, but the major sources of supply are Hungary and Yugoslavia. The market for savory

is growing quickly and its current size is around 150 – 200 tonnes, most of which is used in the retail sector.

The **United Kingdom** and the **Netherlands** annually consume 10 – 15 tonnes and 15 – 25 tonnes of savory respectively, and consumption is growing. The Netherlands, unlike the UK, is able to supply some of its needs from domestic sources, but even so France is the major source of supply. In **Switzerland** and **Belgium,** savory is a very small item involving 2 – 3 tonnes at the most for each country.

PRICES

No detailed price series are available other than those obtained from US trade statistics and New York spot prices as of early March each year (see Table 37). Savory, besides being a herb of minor importance, is also one of the cheapest, and, as Table 37 shows, the average unit value of savory imported into the USA was $0.15 per Kg in 1967. Since this time, the trend has been upwards to a peak of $0.95 per Kg in 1977. The drought in Europe in 1976 created severe shortages and prices in West Germany rose to 13.00 DM per Kg, compared with a normal average price of 3.00 DM per Kg. The New York spot prices for such a small item of trade are unreliable, but when data are available they show prices of over $1.00 per Kg. As regards price differentials, French savory is consistently sold at a higher price than the Yugoslav product, particularly in recent years when French supplies have been tight. The small quantities imported from other countries make it unwise to compare prices, except perhaps to say that the relatively high prices received for the small Dutch and Belgian supplies almost certainly arise from a greater degree of processing.

PROSPECTS

The prospects for a new producer of savory appear attractive, provided that only relatively small quantities of the herb are marketed. The US market for savory is relatively stable compared with the demand for other herbs, and whilst small quantities could be sold in this market, the most attractive markets for any new producer are the Western European countries, especially France and West Germany.

Table 37

Savory: imports into the USA and spot prices

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975[a]	1976[a]	1977[a,b]
TOTAL	Tonnes	14.1	43.5	48.1	28.8	2.0	39.0	85.4	52.5	82.7	60.5	54.2	61.7	94.5	74.8
	$'000[c]	3.0	11.0	11.0	4.4	0.7	14.0	54.2	37.8	50.2	35.2	36.8	46.5	64.5	71.1
	$/Kg	0.22	0.24	0.22	0.15	0.35	0.36	0.63	0.72	0.61	0.58	0.68	0.75	0.68	0.95
of which from:—															
Yugoslavia	Tonnes	...	...	...	24.5	2.0	21.6	39.3	22.1	39.5	39.6	39.4	49.2	75.1	46.2
	$'000	...	...	...	3.2	0.4	5.6	21.3	14.3	20.1	20.7	26.2	35.3	45.7	35.3
	$/Kg	...	...	...	0.13	0.20	0.26	0.54	0.65	0.51	0.52	0.66	0.72	0.61	0.76
France	Tonnes	...	...	...	4.3	—	7.6	39.1	30.4	42.9	20.7	14.6	5.5	16.4	26.6
	$'000	...	...	...	1.2	—	5.4	29.8	23.5	29.1	13.9	10.1	5.5	14.8	33.4
	$/Kg	...	...	...	0.28	—	0.71	0.76	0.77	0.68	0.67	0.69	1.00	0.90	1.25
Netherlands	Tonnes	...	...	...	—	—	—	—	—	0.2	0.2	0.2	—	0.5	0.2
	$'000	...	...	...	—	0.3	—	—	—	0.7	0.6	0.5	—	2.2	1.0
	$/Kg	...	...	...	—	6.67	—	—	—	3.50	3.00	2.50	—	4.40	5.0
Spain	Tonnes	...	...	...	—	—	9.8	4.8	—	—	—	—	6.9	2.5	1.8
	$'000	...	...	...	—	—	3.0	1.7	—	—	—	—	5.7	1.8	1.4
	$/Kg	...	...	...	—	—	0.31	0.35	—	—	—	—	0.83	0.72	0.78
Other countries	Tonnes	...	...	...	—	—	—	2.2	—	0.1	—	—	0.1	—	—
	$'000	...	...	...	—	—	—	1.4	—	0.3	—	—	—	—	—
Approximate New York spot prices as of early March ($/Kg) Yugoslav		...	...	...	...	...	...	1.32	1.19	0.95	0.84	...	1.19	1.10	...

Source: USDA Foreign Agricultural Circular, Tea and Spices, various issues US Tariff Commission (1969)

Notes: (a) In 1975, 1976 and 1977 the USA imported small quantities of processed savory (less than 1 tonne), but these are not included
(b) Preliminary
(c) Market value in country of origin, exclusive of import duty (if any), freight and insurance charges
— nil or negligible
... not available

Chapter 16

Tarragon

INTRODUCTION

Tarragon, *Artemesia dracunculus,* is a perennial herb or semi-shrub belonging to the family Compositae. It is relatively uncommon and difficult to grow. Two types of tarragon are known in commerce, namely Russian tarragon (*A. dracunculoides*), which is a hardier perennial shrub growing to 1.5 metres in height, and the more popular French tarragon (or true tarragon), which reaches only half this height and has deep green narrow leaves, in contrast to Russian tarragon with its lighter leaves. Aroma and flavour properties differ, the French variety has a sweet, aromatic anise-like odour and taste, and is more favoured than the more pungent Russian variety.

The cultivated French tarragon plant rarely produces seed, but is propagated by root or crown division. Good strains are often difficult to obtain, and any seed available is invariably from the inferior Russian tarragon. Replanting should take place approximately every three to four years. Soil and climatic conditions change the flavour and fragrance considerably, even when cuttings are taken from an excellently flavoured parent plant. Harvesting is usually undertaken in June and July just prior to the flowering period. The leaves and tops may be harvested at intervals during the growing season, and in Europe and the USA two harvests per annum are invariably undertaken. The leaves are dehydrated either naturally, in subdued light, or with controlled artificial airflows and heat, to maintain both colour and aroma. The dried leaves are then brought to the desired degree of fragmentation by mechanical grinding, and stored in air-tight containers to prevent loss of flavour.

Tarragon can be grown in temperate climates but thrives best in warm, dry, well-drained light soils in a sunny location.

USES AND QUALITIES

Tarragon is considered a versatile, distinguished, gourmet herb and is particularly employed in French cooking. Its best known use is in tarragon vinegar, which is prepared by steeping the fresh or dried leaves in white vinegar. Tarragon vinegar has many uses, especially in salad dressings and mayonnaise. Tarragon is also used for flavouring mustard, soups, stews, eggs, chicken, salads, meat, lobster, pickles, mushrooms, gherkins and fish dishes. It is also an essential ingredient in 'fines herbes' and various sauces, as well as being used for garnishing fresh salads, flavouring various liqueurs and also in perfumery.

A pale yellow essential oil, commonly called estragon, is produced by steam distillation of the whole upper plant, and this too is used in canning pickles, flavouring vinegar and liqueurs, as well as in perfumery and the manufacture of scented toilet preparations. Tarragon oleoresin is available for use in the food manufacturing industry, especially for use in tarragon vinegar, but only extremely small

quantities of oleoresin are consumed annually. Unlike most herbs, tarragon has rarely been used for medicinal purposes.

PRODUCTION AND TRADE

Tarragon was introduced into Europe from Russia, and today it is cultivated chiefly in the warmer, drier climates of Europe, particularly France, Germany and Yugoslavia. It is also found in European Russia of the USSR, Siberia, Mongolia, northern China and in North America, especially on the west coast. All known commercial production of tarragon is cultivated; it rarely grows wild.

Commercial production of tarragon in the USA is undertaken in California by two or three producers, who produce a type of French tarragon which tends to be cleaner and of better appearance than the imported variety. Domestic production is small, estimates suggesting around 20 tonnes per annum, which constitutes approximately half of total US consumption. The USA is the only source of trade statistics on tarragon, and these are shown in Table 38. The trend since 1964, when tarragon was first separately specified, has been upwards but with wide annual fluctuations. Nevertheless, imports have never exceeded 30 tonnes in any one year, and in the period 1974–77 imports averaged slightly over 15 tonnes, with Yugoslavia and France being the dominant sources of supply. Small quantities of tarragon have also been imported from Belgium, the Netherlands, Hungary and the UK.

No estimates of production levels other than those of the USA are available. Tarragon is produced in southern France and enjoys a wide distribution throughout Western Europe, whilst West Germany and Yugoslavia also produce some French tarragon. Russian tarragon, with its less agreeable flavour than French tarragon, is grown in Eastern Europe, but most of the production appears to be domestically consumed.

The United Kingdom also produces small quantities of French tarragon and one major company recently reported that it was beginning to export English-produced tarragon.

MARKETS

Annual consumption of tarragon in the **USA** has been estimated at about 40–50 tonnes, of which approximately 50 per cent is satisfied from domestic production. Despite the relatively small level of consumption, the demand has been growing fairly rapidly and some trade sources have complained of difficulties in obtaining satisfactory supplies. The major usage is in retail outlets, tarragon being regarded as a gourmet rather than an industrially-used herb. Nevertheless, two sources said there was tremendous growth in demand from the food sevice sector.

France is probably the world's major market for tarragon, one estimate suggesting a consumption of 80–100 tonnes per annum. Most of this is supplied by domestic producers, but Yugoslavia and Poland have also supplied the French market. **West German** sources differ widely in their estimates of consumption; some believe tarragon to be a minor herb with a small market of 10–20 tonnes, one major processor—and a usually reliable source—suggests 70–80 tonnes, whilst a further source suggests a higher figure. As regards the latter, there may again be some confusion between the uses of the dried and fresh product. Domestic production and higher-quality French imports were cited as the major sources of supply, whilst Spain and Morocco were also mentioned.

Consumption in the **Netherlands** is increasing, but does not exceed 25 tonnes. The Dutch produce a limited amount of tarragon themselves, but the quality is inferior to that of French tarragon which accounts for the majority of imports and consumption. Tarragon is sold mainly to the retail sector, but the pickle industry

is also an important user. **Belgium** consumes between 10 and 15 tonnes per annum and this is increasing. Most is imported from France and tarragon vinegar is an important outlet. Consumption in the **United Kingdom** is also estimated at around 10 tonnes a year, and is said to be increasing.

Elsewhere tarragon appears to be a very small item. It is used in northern **Switzerland** in special dishes, but consumption is very small. **Japan** rarely uses tarragon, consumption being less than 5 tonnes per annum, although one source suggested that it might be as high as 20 tonnes.

PRICES

Tarragon is one of the more expensive herbs and, as Table 38 illustrates, the fob unit value has never fallen below $1.00 per Kg during the past decade. During the 1970s the fob unit value of French imports to the USA has usually been over $3.00 per Kg and in 1977 was $8.06 per Kg. The price of Yugoslav tarragon appears generally to be half that of the French product, reflecting the former's poorer quality. A freeze-dried variety is also available, but this is more expensive. Sources believe that prices will continue to increase as costs of production rise and future supply fails to increase sufficiently to meet rising demand.

PROSPECTS

Although only relatively small quantities of tarragon are consumed in comparison with other herbs and spices, the prospects for a new producer of high quality French tarragon are good, provided production is not in excess of about 15–25 tonnes per annum. Substantial production could easily lead to price reductions and, given the cost of tarragon production, this could in turn result in losses. The major problem of producing tarragon, besides the usual difficulties associated with soil and climatic conditions, is the difficulty of obtaining satisfactory root stock. The major market outlets for a new producer would be the USA and Western European countries.

Table 38

Tarragon: imports into the USA

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975[a]	1976[a]	1977[a,b]
TOTAL	Tonnes	8.2	8.6	6.4	15.5	1.5	13.7	6.2	14.0	28.3	13.8	12.8	15.0	18.4	14.3
	$'000[c]	7.0	7.0	8.0	20.9	1.8	24.6	18.2	29.4	75.7	39.3	36.8	35.0	61.0	113.9
	$/Kg	0.86	0.82	1.26	1.35	1.20	1.80	2.94	2.10	2.67	2.85	2.88	2.33	3.32	7.97
of which from:															
Yugoslavia	Tonnes	...	...	...	15.5	1.5	7.8	–	2.0	7.8	5.0	1.6	13.0	8.0	–
	$'000	...	...	...	20.9	1.8	10.3	–	2.0	9.9	9.4	3.0	25.0	14.1	–
	$/Kg	...	...	...	1.35	1.20	1.32	–	1.00	1.27	1.88	1.88	1.92	1.76	–
France	Tonnes	...	...	...	–	–	5.0	4.1	12.0	18.5	8.8	9.3	2.0	10.0	14.0
	$'000	...	...	...	–	–	13.2	12.3	27.4	60.0	29.9	29.8	10.0	44.6	112.8
	$/Kg	...	...	...	–	–	2.64	3.00	2.28	3.24	3.40	3.20	5.00	4.46	8.06
Belgium	Tonnes	...	...	...	–	–	–	2.1	–	2.0	–	–	–	0.3	–
	$'000	...	...	...	–	–	–	5.9	–	5.8	–	–	–	0.7	–
	$/Kg	...	...	...	–	–	–	2.81	–	2.90	–	–	–	2.33	–
Other countries	Tonnes	...	...	...	–	–	0.9	–	–	–	–	1.9	–	0.1	0.3
	$'000	...	...	...	–	–	1.1	–	–	–	–	4.0	–	1.6	1.1

Source: USDA Foreign Agriculture Circular, Tea and Spices, various issues. US Tariff Commission (1969)

Notes: (a) In 1975, 1976 and 1977 the USA imported small quantities of processed tarragon (less than 1.5 tonnes), but these are not included
(b) Preliminary
(c) Market value in country of origin, exclusive of import duty (if any), freight and insurance charges
– nil or negligible
... not available

Chapter 17

Thyme

INTRODUCTION

Thyme is one of the best known European culinary herbs. There are many species of thyme, but all are edible, evergreen perennials. The rubbed thyme herb of commerce is derived mainly from the flowering tops of *Thymus vulgaris* (garden thyme) or *T. zygis* (white thyme), the former having reddish-violet flowers and the latter white flowers with white hairs at the base of the leaves. The two varieties are very similar but the dried herb produced from them can be distinguished by the colour of the flowers as the whole herbaceous top is harvested to produce the culinary herb.

Garden thyme is a hardy perennial plant of the mint family (Labiatae) that grows to around 20 cm in height and can spread to 30 cm or more. The dried curled grey-green or brownish leaves seldom exceed 6 mm in length, and when crushed they yield a sweet, fragrant, aromatic odour, with an undertone of thymol, and have a warm, aromatic, pungent and faintly bitter and medicinal taste.

Other varieties of thyme include wild thyme (*T. serpyllum*), a semi-shrub or perennial herb which is a vigorous creeper, that has become naturalised in many countries. Lemon thyme (*T. citriodorous*) has softer and rounder leaves than garden thyme, and a rich lemon flavour, used to enhance various meats. Other hybrids and varieties of thyme include golden (*T. aureum*), mint, orange and caraway thymes (*T. herba-barona*), the tastes of the last three following their descriptive names.

Thymes thrive under plenty of sun and are drought-resistant. They need little soil and good drainage, but dislike cold wet winters. Propagation is by seed or cutting, preferably being renewed every two or three years, since the plants tend to become woody and the yield falls.

Harvesting of the flowering tops, together with some 50 – 100 mm of the tender leafy stem, takes place when the plants are in bloom. The herb is then shade-dried in an attempt to preserve as much colour as possible. Mechanical harvesting is difficult, hand harvesting and selection being necessary to keep the percentage of stems low. The herb dries well, usually better than most other herbs. It is often possible to undertake two harvests per year.

USES AND QUALITIES

The various kinds of thyme have a wide range of applications, including medicinal, decorative and culinary uses. Considerable culinary use is made of these highly aromatic leaves, particularly with meat and savoury dishes. It is a common kitchen herb in European and American cuisine. Like sage it is commonly used in stuffings, and it is an essential ingredient of 'bouquet garni' and 'mixed herbs'. Often thyme is mixed with marjoram, which can create some con-

fusion (see Chapter 9). Thyme has several other culinary uses, being used to flavour soups, cheese, liver and pork sausages, vegetables, fish, game and poultry dishes, sauerbraten, pizzas and Italian-style sauces. Poor quality thyme is also incorporated into animal feedstuffs. It is said to be one of the herbs used in Benedictine liqueur. Bees have always been partial to this herb and honey made from Greek wild thyme is famous for its unique flavour.

Owing mainly to its thymol content, thyme has considerable germicidal action and disinfectant effects and is used in the treatment of coughs, catarrh and hookworm in animals. It is also used in bath preparations, toothpastes, mouthwashes and perfumery, as well as for the preservation of meat and as a fungicidal ingredient in many anti-mildew preparations. For medicinal purposes it is mainly the essential oil that is employed, the oil also being used extensively in food flavouring and perfumery. An oleoresin is also available and is used mainly by the meat industry, but not in very large quantities.

Thyme is sold in the whole or ground form and the quality characteristics are measured by the volatile oil, total and acid insoluble ash and moisture contents. The quantity of stem must also be limited in a good quality herb. US Government Standards require that the dried leaves shall contain 'not more than 14 per cent total ash, nor more than 4 per cent of ash insoluble in hydrochloric acid'. The Canadian Government standard is similar except that 12 per cent is the total ash permitted. In contrast to most herbs, it has been argued that although the herb can be used fresh, the aroma is more penetrating when dried.

PRODUCTION AND TRADE

The many varieties of thyme grow wild or are cultivated throughout the temperate and subtropical regions of the world, including Europe, the Middle East, Western Asia, North Africa and North America, and are even found close to the Arctic Circle in Greenland, Iceland and Siberia. Thyme is native to the Mediterranean area, and most thyme entering world trade is grown over wide areas on arid mountain slopes and heathlands of southern France, south-east Spain, Morocco, and the Middle East. Thyme is also produced commercially in Turkey, Hungary, Italy, Germany, the UK, the USSR, Poland, Yugoslavia, Czechoslovakia, Greece, Canada and the USA. The herb is both cultivated and collected in its wild state, the latter generally consisting of a combination of several species of *Thymus.*

The widespread nature of production, combined with high levels of local consumption, makes it impossible to estimate world production. Moreover, according to several sources, production from the wild can be increased considerably in the short term if there is sufficient price incentive to encourage it. Despite the lack of production statistics, more trade data are available on thyme than on any other herb. Tables 39 to 45 show the major exporters of thyme and Tables 46 to 60 show major importing countries.

Spain is the major exporter of thyme, but unfortunately the export statistics are not broken down into different types of thyme (see Table 39). The trend of thyme exports has been upwards, exports averaging 806 tonnes per annum from 1968 – 71 and 1 213 tonnes per annum 1972 – 76, with exports surpassing 1 300 tonnes for the first time in 1976. France is the major market, taking 40 per cent of Spanish exports during the period 1968 – 76. Other major markets, in order of importance, are the USA, West Germany and the UK.

French exports of thyme, shown in Table 40, averaged almost 300 tonnes per annum from 1966 to 1976, with a peak of 434 tonnes in 1973. It would seem that the trend of French exports is upwards, particularly when one realises that from 1974, exports of crude wild thyme are recorded separately. In 1974, 65 tonnes of wild thyme were exported, compared with 239 tonnes of other types of thyme, most of which were garden thyme. The USA is the major market for French

thyme, usually taking more than half the total, whilst the UK, Canada and West Germany have taken large but irregular quantities. France also exports small quantities of ground or crushed thyme (see Table 41), and exports averaged 14 tonnes per annum during the period 1966 – 76. The highest level of exports was 39 tonnes in 1976, and the trend appears to be upward.

Turkey has exported sizable amounts of thyme during the past few years (see Table 42). Exports rose from 7 tonnes in 1967 to 266 tonnes in 1974, then fell in 1975 to just below 200 tonnes. In recent years the USA has been the major market for Turkish exports, taking almost exactly 70 per cent in 1974 and 1975. Other important markets include West Germany and France, with smaller quantities exported to Sweden, Canada, the Netherlands and Italy.

Table 43 shows Syrian exports of thyme, and these have shown wide annual fluctuations varying from 1 tonne in 1968 to 259 tonnes in 1970, with no discernible trend apparent. The Lebanon was, until recently, by far the most important purchaser, but the civil war has almost certainly disrupted shipments. In spite of supplying at least eighteen countries during the period 1966 – 76 (particularly in the Middle East), the only other importers of Syrian thyme of any importance are Saudi Arabia, the USA, Jordan and, in 1976, Greece.

Until the outbreak of civil war, the Lebanon was an important exporter of thyme, a considerable proportion of the consignments probably being re-exports from Syria. Table 44 shows Lebanese exports from 1966 to 1973, since when no data have been available. Exports averaged almost 300 tonnes per annum during this period, of which exports to France averaged 213 tonnes. Over thirty other countries were destinations for Lebanese thyme exports, but only Cyprus, Italy and the USA took sizable quantities.

In recent years the trend of Moroccan thyme exports has been downwards, as Table 45 shows. Annual exports averaged 446 tonnes for the periods 1968 – 70 and 1971 – 73, but only 293 tonnes during 1974 – 76. As with the Lebanon, France is by far the dominant market, taking an average of 67 per cent of Moroccan exports during the period 1968 – 76 (an average of 263 tonnes per annum). The other major market, West Germany, averaged 69 tonnes per annum. Other small markets include Cyprus, Italy, Belgium/Luxembourg, the Netherlands and the UK. Morocco also exports a few tonnes of crushed and ground thyme, but as the footnote to Table 45 explains, these are sometimes included in the table and sometimes not.

From Tables 39 – 45 it is apparent that many countries import thyme. US annual imports of thyme, shown in Table 46 averaged 392 tonnes during 1964 – 69 and 487 tonnes during 1970 – 77, and despite sizable annual fluctuations the trend of imports is upward. Spain and France dominate the supply sources, averaging approximately 60 per cent and 35 per cent, respectively, of total imports during the period 1964 – 76. Several other countries, including Greece, Kenya, Sri Lanka, Yugoslavia, Turkey and Peru, have supplied the USA directly but only in relatively very small quantities. The USA also imports very small quantities of manufactured thyme, the total for 1975 being 2.2 tonnes, the main suppliers being the Lebanon and India.

France is a larger importer of thyme than the USA, with annual imports of unground thyme averaging almost 630 tonnes during the decade 1967 – 76 (see Table 47). The trend of imports was upward until 1973 when a peak of almost 1 000 tonnes was reached, since when imports have fluctuated widely. Spain is the major supplier, imports from this source averaging 64 per cent of total imports during the 1970s. France's other major supplier has been Morocco. France separately specifies imports of ground and crushed thyme, but these are small and have been shown as a note to Table 47. Unlike the USA, France differentiates between thyme and wild thyme (*T. serpyllum*). The latter shown in Table 48, and during the period 1974 – 76 averaged 30 tonnes per year. Despite the size

of the French domestic market a large proportion of French imports are subsequently re-exported and this view is supported by French trade sources.

West German imports of thyme are shown in Tables 49 and 50. Imports of unground thyme averaged 205 tonnes per annum in the decade 1967–76. Initially it would appear that imports are falling, but it must be realised that since 1975 imports of wild thyme have been separately specified and that if these are included the trend is upward (see Note (a), Table 49). Spain is the most regular and usually largest source of supply, but sizable and irregular quantities have been obtained from Poland, Romania, Bulgaria and Morocco. Unlike France, West Germany imports sizable quantities of ground thyme as well, averaging 54 tonnes per annum during the decade 1967–76, with Poland, France and Romania being major but irregular suppliers.

The published UK statistics on thyme imports present complications. Before 1974 thyme imports were not separately specified but were combined with bay leaves, and these are shown in Table 54. Imports of thyme are now separated into 'wild thyme, not crushed or ground' (Table 51); 'thyme, other than wild, not crushed or ground' (Table 52) and 'thyme, crushed' (Table 53). Wild thyme imports averaged 78 tonnes during 1974–76 and show a continuously rising trend, reaching nearly 100 tonnes in 1976. Spain dominates supply with small quantities from France and Morocco. Crude thyme imports averaged 122 tonnes per annum during 1973–76 and show a fluctuating but downward trend. Again Spain is the major source, supplying 51 per cent of UK imports during that period, with France supplying 37 per cent. Several other countries, including Morocco, Turkey, Cyprus and Greece, supply small but irregular quantities. Finally, the UK imports small quantities of crushed thyme, averaging 10 tonnes per annum during the period 1973–76, France and Spain being the major suppliers.

Dutch imports of thyme (not ground) show wide annual fluctuations but averaged 35 tonnes per annum from 1966 to 1976 (see Table 55). From 1974 wild thyme imports, which averaged 17 tonnes per annum during the period 1974–76, are excluded from Table 55. If these are included then the trend of imports can be seen to be slightly upward. The major sources of supply are Spain, France and West Germany, in that order. The Netherlands imports much smaller quantities of ground thyme, averaging only 2.5 tonnes annually during 1966–76, with a peak of 7 tonnes in 1973 (see Table 56).

Italian imports of thyme, shown in Tables 57 and 58, are very small, but in recent years have shown a rising trend if one includes wild thyme, which, was separately specified only after 1974. However, the relatively high import levels of 1966 and 1967 have not since been surpassed. Imports of crude thyme (Table 57) averaged 14 tonnes during 1966–76, with Morocco dominating the supply sources. Imports of crushed or ground thyme have risen during the mid-1970s but have not as yet exceeded 5 tonnes per annum (Table 58).

Finally, import data are available for Belgium/Luxembourg. Imports of 'thyme (not crushed or ground)' and 'thyme (crushed or ground)' respectively averaged 34 and 2 tonnes per annum during the period 1966–76 (see Tables 59 and 60).

MARKETS

Thyme produced in the **USA** satisfies less than 2 per cent of US consumption, which is estimated at around 500 tonnes per annum. Opinions differ as to the rate of growth in US consumption, but all trade sources agreed that demand is growing, and according to the general consensus is of the order of 5–10 per cent per annum. As with several other herbs, the increase in demand is partly accounted for by the increased demand for herb mixtures, especially stuffings. This usage, combined with its use in the meat industry, accounts for the major consumption of thyme in the USA.

Thyme is used widely in **France**, and the country is a major producer, exporter and importer of herbs. Retained imports average over 300 tonnes per annum and these, combined with local production, would suggest that domestic consumption is several hundred tonnes per annum; thus thyme is one of the major herbs used in France.

Estimates of thyme consumption in **West Germany** vary considerably, but the majority of estimates, combined with German trade statistics, would suggest a total consumption of between 200 and 300 tonnes a year. There is some domestic production, but this accounts for only a small proportion of consumption. The poorer quality thyme, such as that obtained from Morocco, is cheaper and used mainly by the pharmaceutical industry, whilst the better quality garden thyme is used by the retail sector, both in its own right and in herb mixtures. Consumption in West Germany was thought to be increasing relatively slowly.

After sage, parsley and mint, thyme is probably the most important herb consumed in the **United Kingdom**. Since only very little commercial production is undertaken in the UK, it can be assumed that consumption is satisfied mainly by imports. Total annual imports, shown in Tables 51 – 54 were 222 tonnes in 1974, 151 tonnes in 1975 and 207 tonnes in 1976, which suggests an annual consumption of around 200 tonnes. Both the industrial and retail sectors are important consumers of thyme, and notable applications include stuffings, herb mixtures and pharmaceutical products.

The pharmaceutical industry is an important consumer of thyme in the **Netherlands**, together with the food processing industry. Use by the retail sector is thought to be small, with total consumption estimated currently at about 50 tonnes per annum, and growing at about 5 per cent per annum. Spain and France are quoted as the major sources of supply. **Italy's** consumption of thyme is probably similar to that of the Netherlands, and thyme is certainly used less than in France since marjoram and oregano are often substituted.

Switzerland is a small consumer of thyme, perhaps using 10 – 20 tonnes per annum which is mostly imported from Spain and used in canned meat preservation, butchery and in the retail sector. **Belgium's** consumption is also small. One major dealer gave an estimate of 10 tonnes per annum, but import statistics (see Tables 59 and 60) would suggest a higher consumption of about 40 tonnes per annum if no re-exports are assumed. **Japan's** consumption has been estimated at 40 – 60 tonnes per annum and is used in curry mixes and with meat products.

PRICES

Although fluctuations in the price of thyme have occurred, they have been limited by the fact that thyme has several close substitutes, particularly oregano and marjoram, and also because production can be increased rapidly in the short term, in response to rising prices, by the undertaking of more intensive collection of the wild varieties. The several varieties of thyme on the market, which are very often mixed together, make an analysis of thyme prices difficult. In general the French variety is regarded as having a superior flavour and it is usually more expensive, but, as previously discussed, French exports almost certainly incorporate re-exports. Table 46 shows the unit fob value of French and Spanish imports to the USA; French prices always exceed Spanish prices, usually by at least 30 per cent and often by 60 per cent. French sources quoted prices as wide-ranging as 1.20 – 1.80 FF per Kg for Moroccan, 4.50 FF per Kg for Spanish and 10 – 12 FF per Kg for French (Provence) production. Similarly the unit value of French exports (Table 40) usually exceeds those of Spain (Table 39), Turkey (Table 42), Syria (Table 43), the Lebanon (Table 44) and Morocco (Table 45) by a considerable margin. All the price statistics available show an almost continuous upward trend in thyme prices over the last decade. For example, French export prices doubled from $0.62 per Kg in 1967 to $1.21 in 1976, whilst the unit value of

Spanish exports has risen yearly from $0.21 per Kg in 1968 to $0.66 per Kg in 1976. Similarly, spot prices in New York in March of each year rose from $0.73 per Kg in 1968 to $1.85 in 1978 for French thyme, and from $0.37 to $1.55 – 1.72 for Spanish thyme. Most observers expect prices to increase, not only as a result of general inflation, but also as a result of the greater costs of collecting thyme from the wild. In mid-1978 a US dealer listed thyme oleoresin at $22 per Kg.

PROSPECTS

Although the demand for thyme is growing, it is difficult to predict the future response in supply, since thyme production is both geographically widespread and relatively easily undertaken. Production from the wild makes up a large proportion of quantities entering international trade, and thus any new producer of cultivated thyme may have difficulty competing with existing sources. Some of the major producers, however, particularly France and Spain, are undergoing a rapid increase in production costs and prices of thyme will have to increase if wages are to be maintained at a level to ensure the retention of adequate labour for collection purposes. This, combined with the relatively large trade in thyme, may facilitate the successful entry of a new producer onto the market.

Table 39

Thyme: exports from Spain

		1968[a]	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	709.5	763.7	786.4	963.5	1 262.7	1 298.2	1 210.6	987.2	1 309.0
	$'000	145.6	160.7	191.3	266.4	418.9	583.3	712.0	615.6	865.0
	$/Kg	0.21	0.21	0.24	0.28	0.33	0.45	0.59	0.62	0.66
of which to:										
Federal Republic of Germany	Tonnes	113.6	76.8	123.0	172.2	107.3	99.4	154.5	136.8	183.1
	$'000	19.1	14.7	25.8	41.8	32.0	44.9	84.0	86.5	126.4
	$/Kg	0.17	0.19	0.21	0.24	0.30	0.45	0.54	0.63	0.69
France	Tonnes	269.1	286.4	207.7	346.4	496.0	667.3	546.2	388.8	531.5
	$'000	59.6	54.2	46.0	96.1	167.1	276.5	313.0	211.1	337.2
	$/Kg	0.22	0.19	0.22	0.28	0.34	0.41	0.57	0.54	0.63
Netherlands	Tonnes	12.7	17.7	13.8	6.9	28.5	35.4	12.8	30.5	19.7
	$'000	2.7	4.3	3.6	2.5	10.0	17.1	8.4	20.4	12.7
	$/Kg	0.21	0.24	0.26	0.36	0.35	0.48	0.66	0.67	0.64
UK	Tonnes	70.3	96.5	90.5	83.7	82.7	126.0	107.3	97.4	133.9
	$'000	14.8	24.4	26.8	28.0	30.7	63.6	69.5	78.9	93.9
	$/Kg	0.21	0.25	0.30	0.33	0.37	0.50	0.65	0.81	0.70
Switzerland	Tonnes	6.6	3.9	5.9	13.8	11.8	10.8	20.7	16.7	18.7
	$'000	1.4	1.0	1.9	5.1	6.4	3.5	13.7	12.5	14.4
	$/Kg	0.21	0.25	0.32	0.37	0.54	0.32	0.66	0.75	0.77
Belgium	Tonnes	3.5	3.9	1.9	1.9	8.9	6.9	12.8	8.9	26.6
	$'000	0.7	0.8	0.6	0.8	3.1	3.4	9.2	6.4	19.4
	$/Kg	0.20	0.21	0.32	0.42	0.35	0.49	0.72	0.72	0.73
Austria	Tonnes	7.0	2.9	6.9	6.9	8.9	1.9	2.9	8.9	2.9
	$'000	1.4	0.6	1.6	1.6	2.8	1.0	2.0	7.0	2.2
	$/Kg	0.20	0.21	0.23	0.23	0.31	0.53	0.69	0.79	0.76
Czechoslovakia	Tonnes	3.3	14.8	0.9	0.9	–	–	–	–	4.9
	$'000	2.5	3.1	0.1	0.4	–	–	–	–	4.7
	$/Kg	0.76	0.21	0.11	0.44	–	–	–	–	0.96
Argentina	Tonnes	11.3	13.8	7.9	10.8	8.9	9.8	3.9	–	0.9
	$'000	1.7	2.5	1.8	2.5	2.7	3.9	2.3	–	0.9
	$/Kg	0.15	0.18	0.23	0.23	0.30	0.40	0.59	–	1.00
Canada	Tonnes	2.0	5.9	4.9	5.9	12.8	5.9	7.9	5.9	12.8
	$'000	0.4	1.5	1.5	2.7	6.4	4.3	6.3	4.7	10.0
	$/Kg	0.20	0.25	0.31	0.46	0.50	0.73	0.80	0.80	0.78
USA	Tonnes	171.0	230.3	261.8	273.6	346.4	314.0	321.8	269.7	329.7
	$'000	35.2	52.2	69.1	78.8	116.0	157.1	192.1	176.4	223.4
	$/Kg	0.21	0.23	0.26	0.29	0.33	0.50	0.60	0.65	0.68
Japan	Tonnes	27.4	–	–	29.5	19.7	9.8	–	9.8	19.7
	$'000	3.8	–	–	3.8	3.7	2.1	–	3.2	6.8
	$/Kg	0.14	–	–	0.13	0.19	0.21	–	0.33	0.35
Other countries	Tonnes	11.6	10.8	61.2	14.0	128.8	10.0	19.8	13.8	24.6
	$'000	2.3	1.4	12.5	3.9	39.3	3.0	11.5	8.5	13.0

Source: Estadistica del Comercio Exterior de España

Notes: (a) Not separately specified before 1968
– nil or negligible

Table 40

Thyme (not crushed or ground): exports from France

		1966	1967	1968	1969	1970	1971	1972	1973	1974 [a]	1975	1976
TOTAL	Tonnes	339.0	356.0	193.0	254.0	249.0	269.0	312.0	434.0	239.0	254.0	342.0
	$'000	194.2	222.0	125.4	167.9	160.2	184.8	244.4	383.7	273.2	346.0	414.1
	$/Kg	0.57	0.62	0.65	0.66	0.64	0.69	0.78	0.88	1.14	1.36	1.21
of which to:												
USA	Tonnes	156.0	227.0	59.0	142.0	128.0	169.0	187.0	258.0	125.0	111.0	172.0
	$'000	94.2	137.5	34.0	79.3	72.2	97.8	113.2	187.2	104.0	113.8	188.5
	$/Kg	0.60	0.61	0.58	0.56	0.56	0.58	0.61	0.73	0.83	1.03	1.10
UK	Tonnes	77.0	55.0	63.0	29.0	–	–	–	50.0	–	–	–
	$'000	40.9	29.6	36.1	18.5	–	–	–	44.9	–	–	–
	$/Kg	0.53	0.54	0.57	0.64	–	–	–	0.90	–	–	–
Canada	Tonnes	27.0	20.0	18.0	23.0	29.0	21.0	27.0	–	–	–	–
	$'000	16.2	13.8	12.6	19.8	22.3	20.4	30.5	–	–	–	–
	$/Kg	0.60	0.69	0.70	0.86	0.77	0.97	1.13	–	–	–	–
Other countries	Tonnes	79.0	54.0	53.0	60.0	92.0	79.0	98.0	126.0	114.0	143.0	170.0
	$'000	42.9	41.1	42.7	50.2	65.7	66.6	100.8	151.5	169.2	232.1	225.5

Source: Statistiques du Commerce Extérieur de la France

Notes: (a) Wild thyme shown separately from 1974. In 1974 France exported 65.0 tonnes of wild thyme, valued at US$ 84 800. Of this 37 tonnes, valued at US$ 51,100, went to the Federal Republic of Germany

– nil or negligible

Table 41

Thyme (crushed or ground): exports from France

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	5.0	13.0	12.0	12.0	8.0	11.0	10.0	11.0	25.0	10.0	39.0
	$'000	3.8	6.3	8.7	10.0	7.6	14.4	7.3	18.4	29.9	13.1	51.1
	$/Kg	0.76	0.48	0.73	0.83	0.95	1.31	0.73	1.67	1.20	1.31	1.31

Source: Statistiques du Commerce Extérieur de la France

Table 42

Thyme: exports from Turkey

		1967	1968	1969	1970	1971	1972	1973	1974	1975
TOTAL	Tonnes	7.3	20.8	22.5	46.0	41.9	51.1	204.1	265.5	196.4
	$'000	1.9	5.5	5.1	12.0	19.5	17.1	136.3	357.7	256.2
	$/Kg	0.26	0.26	0.23	0.26	0.47	0.33	0.67	1.35	1.30
of which to:										
Federal Republic of Germany	Tonnes	–	–	3.2	15.5	13.7	23.2	38.5	55.3	39.3
	$'000	–	–	0.6	3.4	3.5	7.9	26.6	60.4	55.5
	$/Kg	–	–	0.19	0.22	0.26	0.34	0.69	1.09	1.41
France	Tonnes	–	–	13.6	17.0	13.8	9.6	40.2	7.5	10.0
	$'000	–	–	2.9	4.4	11.4	2.6	16.9	5.6	4.9
	$/Kg	–	–	0.21	0.26	0.83	0.27	0.42	0.75	0.49
Sweden	Tonnes	1.8	3.0	4.0	6.0	8.5	5.0	12.0	6.5	1.5
	$'000	0.4	1.0	1.3	2.1	2.8	2.1	7.8	8.9	2.0
	$/Kg	0.22	0.33	0.33	0.34	0.33	0.42	0.65	1.37	1.33
USA	Tonnes	–	–	–	–	–	5.0	87.5	185.7	137.4
	$'000	–	–	–	–	–	2.3	67.0	269.0	182.0
	$/Kg	–	–	–	–	–	0.46	0.77	1.45	1.32
Canada	Tonnes	–	–	–	–	–	–	16.5	5.5	5.0
	$'000	–	–	–	–	–	–	12.8	7.9	7.1
	$/Kg	–	–	–	–	–	–	0.78	1.44	1.42
Netherlands	Tonnes	5.0	17.2	0.5	2.5	6.0	5.1	1.0	–	–
	$'000	1.2	4.3	0.1	0.8	1.9	1.3	0.6	–	–
	$/Kg	0.24	0.25	0.20	0.32	0.32	0.25	0.60	–	–
Italy	Tonnes	0.5	0.5	–	–	–	–	2.0	2.0	1.0
	$'000	0.2	0.1	–	–	–	–	1.2	1.5	1.4
	$/Kg	0.40	0.20	–	–	–	–	0.60	0.75	1.40
Other countries	Tonnes	–	0.1	1.2	5.0	–	3.2	6.4	3.0	2.2
	$'000	0.1	0.1	0.2	1.3	–	0.9	3.4	4.4	3.3

Source: Annual Foreign Trade Statistics, Turkey

Note: – nil or negligible

Table 43

Thyme: exports from Syria

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	105.2	...	0.7	83.9	259.4	40.4	35.2	87.1	170.7	...	83.2
	$'000	4.6	...	0.2	6.6	14.9	27.0	12.3	6.2	32.2	...	32.8
	$/Kg	0.04	...	0.29	0.08	0.06	0.67	0.35	0.07	0.19	...	0.39
of which to:												
Lebanon	Tonnes	102.2	...	–	72.4	237.5	15.5	11.4	81.8	141.3	...	6.6
	$'000	3.6	...	–	3.0	8.5	21.2	8.1	3.3	19.7	...	0.7
	$/Kg	0.04	...	–	0.04	0.04	1.37	0.71	0.04	0.14	...	0.11
Saudi Arabia	Tonnes	1.2	...	–	3.5	2.2	8.2	5.5	1.7	9.7	...	6.0
	$'000	0.3	...	–	0.7	0.5	2.2	1.2	1.0	5.9	...	5.9
	$/Kg	0.25	...	–	0.20	0.23	0.27	0.22	0.59	0.61	...	0.98
Kuwait	Tonnes	–	...	–	5.9	1.3	6.3	2.0	–	0.6	...	2.0
	$'000	–	...	–	2.1	0.4	1.1	0.3	–	0.2	...	1.3
	$/Kg	–	...	–	0.36	0.31	0.17	0.15	–	0.33	...	0.65
Qatar	Tonnes	–	...	–	0.4	0.1	1.2	1.0	–	2.3	...	–
	$'000	–	...	–	0.1	–	0.3	0.3	–	1.2	....	–
	$/Kg	–	...	–	0.25	0.33	0.25	0.30	–	0.52	...	–
Jordan	Tonnes	–	...	–	–	–	–	–	2.8	5.6	...	13.6
	$'000	–	...	–	–	–	–	–	1.0	0.8	...	3.2
	$/Kg	–	...	–	–	–	–	–	0.36	0.14	...	0.24
USA	Tonnes	1.8	...	–	0.9	6.5	1.9	8.1	–	4.1	...	18.6
	$'000	0.7	...	–	0.4	2.9	0.3	1.0	–	2.8	...	12.6
	$/Kg	0.39	...	–	0.44	0.45	0.16	0.12	–	0.68	...	0.68
Other countries	Tonnes	–	...	0.7	0.8	11.8	7.3	7.2	0.8	7.1	...	36.4
	$'000	–	...	0.2	0.3	2.6	1.9	1.4	0.9	1.6	...	9.1

Source: Statistiques du Commerce Extérieur – Republique Arabe Syrienne

Notes: – nil or negligible
. . .not available

Table 44

Thyme: exports from the Lebanon

		1966	1967	1968	1969	1970	1971	1972	1973[a]
TOTAL	Tonnes	274.1	171.4	244.0	308.2	383.5	335.0	345.7	328.5
	$'000	37.7	24.3	37.0	39.1	39.4	34.1	45.4	56.5
	$/Kg	0.14	0.14	0.15	0.13	0.10	0.10	0.13	0.17
of which to:									
France	Tonnes	149.2	132.8	161.2	228.5	307.1	240.5	242.1	237.8
	$'000	17.1	16.8	19.8	29.0	30.4	22.7	28.0	35.6
	$/Kg	0.11	0.13	0.12	0.13	0.10	0.09	0.12	0.15
Cyprus	Tonnes	16.8	17.0	30.0	20.7	30.7	46.5	22.8	37.4
	$'000	2.3	2.5	3.8	2.7	3.2	4.4	3.0	10.0
	$/Kg	0.14	0.15	0.13	0.13	0.10	0.09	0.13	0.27
Italy	Tonnes	11.4	10.5	7.8	49.8	34.1	18.5	35.8	17.4
	$'000	1.8	1.7	1.4	5.3	3.3	1.9	4.7	2.7
	$/Kg	0.16	0.16	0.18	0.11	0.10	0.10	0.13	0.16
USA	Tonnes	–	–	10.0	1.2	5.5	15.0	21.5	30.3
	$'000	–	–	1.7	0.2	0.6	1.4	2.5	5.2
	$/Kg	–	–	0.17	0.17	0.11	0.09	0.12	0.17
Canada	Tonnes	0.1	0.3	–	0.1	0.1	–	0.3	0.3
	$'000	–	0.2	–	0.1	0.1	–	0.2	0.2
	$/Kg	0.32	0.67	–	1.00	1.00	–	0.67	0.67
Kuwait	Tonnes	1.0	3.4	2.2	1.3	0.8	2.4	1.3	1.4
	$'000	0.9	1.0	0.8	0.5	0.3	0.9	0.4	0.6
	$/Kg	0.90	0.29	0.36	0.38	0.38	0.38	0.31	0.43
Qatar	Tonnes	0.8	0.1	1.2	–	–	7.5	2.6	0.6
	$'000	0.4	–	0.2	–	–	0.9	1.0	0.3
	$/Kg	0.50	0.29	0.17	–	–	0.12	0.38	0.50
Saudi Arabia	Tonnes	1.0	1.8	2.2	3.6	0.6	1.1	0.7	0.8
	$'000	0.4	0.5	0.5	0.7	0.2	0.4	0.4	0.4
	$/Kg	0.40	0.28	0.23	0.19	0.33	0.36	0.57	0.50

Table 44—*continued*

Thyme: exports from the Lebanon

		1966	1967	1968	1969	1970	1971	1972	1973[a]
Libya	Tonnes	–	0.5	5.1	0.1	0.2	0.5	1.1	1.1
	$'000	–	0.4	6.5	0.1	0.2	0.4	0.6	0.9
	$/Kg	–	0.80	1.27	1.00	1.00	0.80	0.55	0.82
Sierra Leone	Tonnes	0.4	0.1	0.4	0.4	–	–	0.4	0.1
	$'000	0.3	0.1	0.1	0.1	–	–	0.2	–
	$/Kg	0.75	1.00	0.25	0.25	–	–	0.50	0.25
Senegal	Tonnes	0.1	0.3	0.3	0.9	0.1	0.4	–	0.4
	$'000	0.1	0.1	0.2	0.1	–	0.1	–	0.1
	$/Kg	1.00	0.33	0.67	0.11	0.30	0.25	–	0.25
Ghana	Tonnes	0.7	0.2	0.1	0.4	–	–	–	0.1
	$'000	0.5	0.1	–	0.2	–	–	–	0.1
	$/Kg	0.71	0.50	0.34	0.50	–	–	–	1.00
Nigeria	Tonnes	0.1	0.5	0.1	0.1	–	0.4	–	0.1
	$'000	0.1	0.2	0.1	0.1	–	0.2	–	–
	$/Kg	1.00	0.40	1.00	1.00	–	0.50	–	0.42
Other countries	Tonnes	92.5	3.9	23.4	1.1	4.3	2.2	17.1	0.7
	$'000	13.8	0.7	1.9	–	1.1	0.8	4.4	0.4

Source: Statistiques du Commerce Exterieur – Republique Libanaise

Notes: (a) Data are not available after 1973
– nil or negligible

Table 45

Thyme*: exports from Morocco

		1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	404.2	521.2	413.1	301.1	434.7	601.5	380.2	222.6	274.0
	$'000	36.1	54.8	44.9	36.5	54.9	114.3	105.4	64.3	82.8
	$/Kg	0.09	0.11	0.11	0.12	0.13	0.19	0.28	0.29	0.30
of which to:										
France	Tonnes	275.6	399.5	262.0	231.7	336.5	361.4	221.8	119.4	158.9
	$'000	21.0	41.6	28.7	29.2	44.7	72.5	64.6	37.2	50.5
	$/Kg	0.08	0.10	0.11	0.13	0.13	0.20	0.29	0.31	0.32
Federal Republic of Germany	Tonnes	60.6	48.7	78.4	43.9	65.7	135.4	96.4	48.2	44.6
	$'000	5.9	4.0	5.9	2.8	4.8	15.4	22.1	10.8	9.3
	$/Kg	0.10	0.08	0.08	0.06	0.07	0.11	0.23	0.22	0.21
Cyprus	Tonnes	22.2	32.9	29.0	2.9	10.8	70.8	8.9	15.5	19.3
	$'000	3.1	4.8	5.3	0.6	2.4	19.7	3.0	4.9	6.9
	$/Kg	0.14	0.15	0.18	0.21	0.22	0.28	0.34	0.32	0.36
Italy	Tonnes	10.8	19.4	19.8	19.7	8.2	9.3	16.2	9.7	15.0
	$'000	2.1	2.5	3.0	3.5	1.5	2.6	5.6	3.5	5.7
	$/Kg	0.19	0.13	0.15	0.18	0.18	0.28	0.35	0.36	0.38
Belgium/Luxembourg	Tonnes	5.8	15.6	15.1	–	10.6	9.9	11.4	15.6	4.8
	$'000	0.6	1.3	1.0	–	1.0	1.4	2.4	4.7	1.5
	$/Kg	0.10	0.08	0.07	–	0.09	0.14	0.21	0.30	0.31
Netherlands	Tonnes	–	–	6.8	1.0	–	2.0	10.0	9.7	9.7
	$'000	–	–	1.0	0.1	–	0.3	1.8	2.0	2.1
	$/kg	–	–	0.15	0.10	–	0.15	0.18	0.21	0.22
UK	Tonnes	–	–	–	–	–	2.9	14.7	–	14.9
	$'000	–	–	–	–	–	0.7	5.4	–	4.7
	$/Kg	–	–	–	–	–	0.24	0.37	–	0.32
Other countries	Tonnes	29.2	5.1	2.0	1.9	2.9	9.8	0.8	4.5	6.8
	$'000	3.4	0.6	–	0.3	0.5	1.7	0.5	1.2	2.1

Source: Statistiques du Commerce Extérieur—Morocco

Notes: * Not specified whether 'crushed and ground' or not, except in 1972 and 1976. In 1972 4.8 tonnes of crushed and ground thyme valued at US$ 700 were exported to Spain, and in 1976 3.2 tonnes of crushed and ground thyme valued at US$ 900 were exported, mainly to France, but these are not included

– nil or negligible

Table 46

Thyme: imports into the USA and spot prices

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975[a]	1976	1977[b]	1978
TOTAL	Tonnes	403.5	484.2	356.0	432.3	280.5	395.6	409.9	390.0	503.4	601.8	506.4	391.9	518.7	574.3	...
	$'000[c]	152.3	198.2	163.7	185.1	101.2	149.2	150.2	175.9	220.6	346.9	336.7	294.7	419.0	561.2	...
	$/Kg	0.38	0.41	0.46	0.43	0.36	0.38	0.37	0.45	0.44	0.58	0.66	0.75	0.81	0.97	...
of which from:																
Spain	Tonnes	250.8	337.3	167.3	244.7	180.3	253.9	269.7	249.7	305.3	331.2	336.8	284.1	342.3	413.4	...
	$'000	70.7	110.3	51.4	65.6	41.3	64.2	75.7	77.0	103.2	161.0	202.1	191.6	235.2	362.7	...
	$/Kg	0.28	0.33	0.31	0.27	0.23	0.25	0.28	0.31	0.34	0.49	0.60	0.67	0.69	0.88	...
France	Tonnes	151.8	146.9	183.8	181.5	96.2	141.7	135.3	128.0	196.3	270.6	159.3	106.5	166.3	152.5	...
	$'000	81.4	88.0	110.8	114.9	59.0	85.0	70.8	80.9	115.2	185.9	121.2	99.0	169.0	183.1	...
	$/Kg	0.54	0.60	0.60	0.63	0.61	0.60	0.52	0.63	0.59	0.69	0.76	0.93	1.02	1.20	...
Greece	Tonnes	–	–	–	2.2	–	–	–	–	1.8	–	0.3	–	9.4	6.0	...
	$'000	–	–	–	2.0	–	–	–	–	1.2	–	0.7	–	11.7	10.6	...
	$/Kg	–	–	–	0.91	–	–	–	–	0.67	–	2.33	–	1.24	1.77	...
Other countries	Tonnes	0.9	–	4.9	3.9	4.0	–	4.9	12.3	–	–	10.0	1.3	0.7	2.4	...
	$'000	0.2	–	1.5	2.6	0.9	–	3.7	18.0	1.0	–	12.7	4.1	3.1	4.8	...
Approximate New York spot prices as of early March ($/Kg)																
French		...	...	0.75	0.73	0.73	0.71	0.83	0.84	0.93	1.04	1.16	1.21	1.41	1.65	1.85
Spanish		...	...	0.44	0.40	0.37	0.30	0.42	0.55	0.57	0.86	0.88	0.95	0.95	1.26	1.55
																–1.72

Source: USDA Foreign Agriculture Circulars, Tea and Spices, various issues

Notes: (a) In 1975 the USA imported 2.2. tonnes of manufactured thyme, valued at US$ 7 500. 1.4 tonnes valued at US$ 1 500 came from the Lebanon and 0.2 tonnes valued at US$ 5 000 came from India. These are not included
(b) Preliminary
(c) Market value in country of origin, exclusive of import duty (if any), freight and insurance charges
– nil or negligible
... not available

Table 47

Thyme (not crushed or ground): imports into France

		1967	1968	1969	1970	1971	1972	1973	1974[(a)]	1975[(a)]	1976[(a)]
TOTAL	Tonnes	493.0	483.0	591.0	473.0	635.0	702.0	991.0	799.0	475.0	650.0
	$'000	92.0	86.0	100.0	82.0	147.0	195.0	367.0	384.0	231.0	391.0
	$/Kg	0.19	0.18	0.17	0.17	0.23	0.28	0.37	0.48	0.49	0.60
Of which from:											
Spain	Tonnes	274.0	258.0	247.0	183.0	332.0	401.0	656.0	524.0	399.0	515.0
	$'000	70.0	65.0	60.0	45.0	110.0	152.0	293.0	319.0	206.0	341.0
	$/Kg	0.26	0.25	0.24	0.25	0.33	0.38	0.45	0.61	0.52	0.66
Morocco	Tonnes	216.0	213.0	334.0	281.0	277.0	291.0	303.0	272.0	. . .	. . .
	$'000	20.0	19.0	38.0	34.0	36.0	41.0	63.0	62.0	. . .	. . .
	$/Kg	0.09	0.09	0.11	0.12	0.13	0.14	0.21	0.23	. . .	. . .
Other countries	Tonnes	3.0	12.0	10.0	9.0	26.0	10.0	32.0	3.0	76.0	135.0
	$'000	2.0	2.0	2.0	3.0	1.0	2.0	11.0	3.0	25.0	50.0

Source: Statistiques du Commerce Extérieur de la France

Notes: (a) Imports of crushed and ground thyme were negligible until 1974. They were 3 tonnes in 1975 and 18 tonnes in 1976. These are not included
... not available

Table 48

Wild thyme (not crushed or ground): imports into France

		1974	1975	1976
TOTAL	Tonnes	47.0	17.0	26.0
	$'000	18.0	7.0	11.0
	$/Kg	0.38	0.41	0.42

Source: Statistiques du Commerce Extérieur de la France

Notes: – nil or negligible
. . . not available

Table 49

Thyme (not ground): imports into the Federal Republic of Germany

		1967	1968	1969	1970	1971	1972	1973	1974	1975[a]	1976[a]
TOTAL	Tonnes	173.6	208.9	187.2	204.0	216.1	206.8	247.5	266.9	146.1	188.6
	$'000	33.0	47.0	49.0	44.0	68.0	69.0	102.0	153.0	110.0	179.0
	$/Kg	0.19	0.22	0.26	0.22	0.31	0.33	0.41	0.57	0.75	0.95
of which from:											
Spain	Tonnes	50.8	97.3	80.6	60.7	83.7	84.9	80.5	99.9	97.4	134.0
	$'000	13.0	20.0	19.0	16.0	24.0	31.0	42.0	63.0	68.0	94.0
	$/Kg	0.25	0.21	0.24	0.26	0.29	0.37	0.52	0.63	0.70	0.70
Poland	Tonnes	...	13.6	18.7	...	...	...	...	11.3	...	30.0
	$'000	...	7.0	13.0	...	...	...	...	19.0	...	58.0
	$/Kg	...	0.51	0.70	...	...	...	...	1.68	...	1.93
Romania	Tonnes	15.6	14.3	...	...	29.3	10.0	17.1	13.4	...	...
	$'000	7.0	7.0	...	...	27.0	12.0	26.0	22.0	...	...
	$/Kg	0.45	0.49	...	...	0.92	1.20	1.52	1.64	...	...
Morocco	Tonnes	...	48.0	...	71.1	...	58.0	106.3	60.6	...	...
	$'000	...	6.0	...	9.0	...	9.0	22.0	19.0	...	...
	$/Kg	...	0.13	...	0.13	...	0.16	0.21	0.31	...	...
Bulgaria	Tonnes	74.8	...	...	...	70.2	...	...	...	...	...
	$'000	8.0	...	...	...	11.0	...	...	...	...	...
	$/Kg	0.11	...	...	...	0.16	...	...	...	...	...
Other countries	Tonnes	32.4	35.7	87.9	72.2	32.9	53.9	43.6	81.7	48.7	24.6
	$'000	5.0	7.0	17.0	19.0	6.0	17.0	12.0	30.0	42.0	27.0

Source: Aussenhandel — Spezialhandel nach Waren und Ländern

Note: (a) Before 1975 imports of wild thyme (not ground) were not separately specified. In 1975 85.8 tonnes valued at $39 000 and in 1976 105.4 tonnes valued at $50 000 were imported, but these are not included

... not available

Table 50

Thyme (ground): imports into the Federal Republic of Germany

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	22.8	44.7	52.2	51.8	61.4	50.1	49.0	63.6	61.8	86.4
	$'000	10.0	23.0	23.0	25.0	38.0	49.0	65.0	92.0	115.0	109.0
	$/Kg	0.44	0.51	0.44	0.48	0.62	0.98	1.33	1.45	1.86	1.26
of which from:											
Poland	Tonnes	...	...	25.7	...	...	...	...	...	...	28.0
	$'000	...	...	11.0	...	...	...	...	...	...	51.0
	$/Kg	...	...	0.43	...	...	...	...	...	...	1.82
France	Tonnes	...	...	...	...	11.9	23.9	26.9	39.0	26.5	...
	$'000	...	...	...	...	10.0	23.0	39.0	54.0	45.0	...
	$/Kg	...	...	...	...	0.84	0.96	1.45	1.38	1.70	...
Romania	Tonnes	...	22.8	...	14.2	15.1	...	...	...	...	...
	$'000	...	11.0	...	11.0	19.0	...	...	...	...	...
	$/Kg	...	0.48	...	0.77	1.26	...	...	...	...	...
Other countries	Tonnes	22.8	21.9	26.5	51.8	35.3	11.1	22.1	24.6	35.3	58.4
	$'000	10.0	12.0	12.0	25.0	17.0	7.0	26.0	38.0	70.0	58.0

Source: Aussenhandel – Spezialhandel nach Waren und Ländern

Note: . . . not available

Table 51

Wild thyme (not crushed or ground): imports into the UK

		1974[a]	1975	1976
TOTAL	Tonnes	66.2	72.8	95.9
	£'000	19.6	29.8	42.2
	$'000	45.8	66.3	76.2
	$/Kg	0.69	0.91	0.79
of which from:				
Spain	Tonnes	66.0	72.8	82.9
	£'000	19.5	29.8	35.5
	$'000	45.6	66.3	64.1
	$/Kg	0.69	0.91	0.77
France	Tonnes	0.2	–	8.0
	£'000	0.1	–	5.5
	$'000	0.3	–	9.9
	$/Kg	1.50	–	1.24
Morocco	Tonnes	–	–	5.0
	£'000	–	–	1.2
	$'000	–	–	2.2
	$/Kg	–	–	0.44

Source: Trade Statistics of the UK H.M. Customs & Excise

Notes: (a) Not separately specified before 1974
– nil or negligible

Table 52

Thyme, other than wild, (not crushed or ground): imports into the UK

		1973[a, b]	1974	1975	1976
TOTAL	Tonnes	175.3	150.3	66.5	96.8
	£'000	50.5	37.3	31.9	46.6
	$'000	123.8	87.3	70.8	84.1
	$/Kg	0.71	0.58	1.06	0.87
of which from:					
Spain	Tonnes	101.4	67.9	27.1	51.0
	£'000	24.2	14.0	8.6	22.6
	$'000	59.4	32.8	19.2	40.8
	$/Kg	0.59	0.48	0.71	0.80
France	Tonnes	57.2	52.4	38.9	34.4
	£'000	22.1	17.1	22.8	21.0
	$'000	54.1	40.0	50.6	38.0
	$/Kg	0.95	0.76	1.30	1.10
Morocco	Tonnes	2.9	24.0	–	9.9
	£'000	0.4	2.9	–	2.0
	$'000	1.1	6.8	–	3.6
	$/Kg	0.38	0.28	–	0.36
Other countries	Tonnes	13.8	6.0	0.5	1.5
	£'000	3.8	3.3	0.4	0.9
	$'000	9.2	7.7	1.0	1.7

Source: Trade Statistics of the UK H.M. Customs & Excise

Notes: (a) Not separately specified before 1973
(b) From February to December 1973
– nil or negligible

Table 53

Thyme (crushed)*: imports into the UK

		1973[a, b]	1974	1975	1976
TOTAL	Tonnes	8.0	5.5	11.8	14.0
	£'000	2.1	3.6	6.6	8.1
	$'000	5.2	8.5	14.6	14.6
	$/Kg	0.65	1.55	1.24	1.04
of which from:					
France	Tonnes	–	4.8	9.8	11.9
	£'000	–	3.2	5.9	7.3
	$'000	–	7.6	13.0	13.2
	$/Kg	–	1.58	1.31	1.11
Spain	Tonnes	8.0	–	2.0	–
	£'000	2.1	–	0.7	–
	$'000	5.2	–	1.6	–
	$/Kg	0.65	–	0.80	–
Canada	Tonnes	–	0.7	–	–
	£'000	–	0.4	–	–
	$'000	–	0.9	–	–
	$/Kg	–	1.29	–	–
Turkey	Tonnes	–	–	–	2.0
	£'000	–	–	–	0.7
	$'000	–	–	–	1.2
	$/Kg	–	–	–	0.60
USA	Tonnes	–	–	–	0.1
	£'000	–	–	–	0.1
	$'000	–	–	–	0.2
	$/Kg	–	–	–	2.00

Source: Trade Statistics of the UK H.M. Customs & Excise

Notes: * The UK imported 4.9 tonnes of ground thyme valued at £3 800 during the period Feb–Dec 1973, the bulk of which was from Kenya and India, and in 1976 imported 2.3 tonnes valued at £3 200, mainly from Belgium/Luxembourg. In 1974 and 1975 the quantity of imports was below 1 tonne. These are not included

(a) Not separately specified before 1973

(b) From February to December 1973

– nil or negligible

Table 54

Thyme and bay leaves (not ground): imports into the UK

		1970[a]	1971	1972	1973[b]
TOTAL	Tonnes	124.6	122.2	174.9	58.2
	£'000	31.4	28.8	39.5	15.9
	$'000	75.3	70.5	98.9	38.9
	$/Kg	0.60	0.58	0.57	0.67
of which from:					
Turkey	Tonnes	53.5	51.1	62.5	39.1
	£'000	8.5	8.4	13.0	11.3
	$'000	20.4	20.5	32.4	27.8
	$/Kg	0.38	0.40	0.52	0.71
Spain	Tonnes	28.0	32.0	55.0	12.3
	£'000	3.4	4.4	9.0	2.2
	$'000	8.1	10.8	22.4	5.5
	$/Kg	0.29	0.34	0.41	0.45
France	Tonnes	32.3	24.2	42.1	4.2
	£'000	8.6	6.4	13.1	1.6
	$'000	20.6	15.6	32.7	3.9
	$/Kg	0.64	0.64	0.78	0.93
Greece	Tonnes	2.0	1.0	3.5	2.5
	£'000	0.3	0.1	1.0	0.6
	$'000	0.6	0.3	2.6	1.5
	$/Kg	0.30	0.30	0.74	0.60
Federal Republic of Germany	Tonnes	0.1	1.4	0.2	0.1
	£'000	0.2	0.5	0.4	0.1
	$'000	0.4	1.3	1.1	0.2
	$/Kg	4.00	0.93	5.50	2.00
Canada	Tonnes	4.4	1.0	2.5	–
	£'000	2.8	1.1	0.9	–
	$'000	6.7	2.8	2.2	–
	$/Kg	1.52	2.80	0.88	–
USA	Tonnes	0.8	1.3	–	–
	£'000	7.3	6.4	0.5	–
	$'000	17.4	15.6	1.2	–
	$/Kg	21.75	12.00	–	–
Other countries	Tonnes	3.5	10.2	9.1	–
	£'000	0.5	1.5	1.8	–
	$'000	1.1	3.6	4.3	–

Source: Trade Statistics in the UK H.M. Customs & Excise

Notes: (a) Not separately specified before 1970
(b) January 1973 only. From this date the category was reclassified
– nil or negligible

Table 55

Thyme (not ground): imports into the Netherlands

		1966	1967	1968	1969	1970	1971	1972	1973	1974[a]	1975[a]	1976[a]
TOTAL	Tonnes	34.0	18.0	31.0	40.0	39.0	29.0	51.0	54.0	15.0	33.0	36.0
	$'000	13.5	8.0	9.9	11.6	14.6	14.0	23.4	32.9	16.7	34.4	40.5
	$/Kg	0.40	0.44	0.32	0.29	0.37	0.48	0.46	0.61	1.11	1.04	1.13
of which from:												
Spain	Tonnes	17.0	–	16.0	20.0	14.0	–	25.0	32.0	9.0	19.0	...
	$'000	5.2	–	4.4	5.5	4.1	–	10.0	17.5	6.0	13.4	...
	$/Kg	0.31	–	0.28	0.28	0.29	–	0.40	0.55	0.67	0.71	...
France	Tonnes	13.0	6.0	6.0	7.0	–	10.0	7.0	10.0	5.0	12.0	...
	$'000	6.6	3.0	3.0	3.6	–	4.9	5.0	7.2	4.4	13.0	...
	$/Kg	0.51	0.50	0.50	0.51	–	0.49	0.71	0.72	0.90	1.08	...
Federal Republic of Germany	Tonnes	–	–	–	–	7.0	10.0	17.0	9.0	1.0	–	...
	$'000	–	–	–	–	5.5	6.3	8.1	7.5	6.3	–	...
	$/Kg	–	–	–	–	0.79	0.63	0.48	0.83	6.3	–	...
Other countries	Tonnes	4.0	12.0	9.0	13.0	18.0	9.0	2.0	3.0	–	2.0	...
	$'000	1.7	5.0	2.5	2.5	5.0	2.8	0.3	0.7	–	8.0	...

Source: Maandstatistiek van de Buitenlandse Handel

Note: (a) Excludes wild thyme from 1974. Figures for wild thyme are as follows:

		1974	1975	1976
TOTAL	Tonnes	14.0	17.0	21.0
	$'000	6.7	9.5	11.0
	$/Kg	0.48	0.56	0.52

– nil or negligible

Table 56

Thyme (ground): imports into the Netherlands

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	3.0	1.0	2.0	–	1.0	1.0	1.0	7.0	3.0	5.0	3.0
	$'000	2.8	1.7	0.6	0.3	1.7	3.4	5.9	11.1	7.8	11.1	8.7
	$/Kg	0.93	1.70	0.30	–	1.70	3.40	5.90	1.59	2.60	2.22	2.90
of which from:												
Federal Republic of Germany	Tonnes	–	–	–	–	–	1.0	1.0	1.0	–	–	–
	$'000	–	–	–	–	–	3.1	5.3	6.8	–	–	–
	$/Kg	–	–	–	–	–	3.10	5.30	6.80	–	–	–
Other countries	Tonnes	3.0	1.0	2.0	–	1.0	–	–	6.0	3.0	5.0	3.0
	$'000	2.8	1.7	0.6	0.3	1.7	0.3	0.6	4.3	7.8	11.1	8.7

Source: Maandstatistiek van de Buitenlandse Handel

Note: – nil or negligible

Table 57

Thyme (not ground or crushed): imports into Italy

		1966	1967	1968	1969	1970	1971	1972	1973	1974[a]	1975[a]	1976[a]
TOTAL	Tonnes	27.3	36.2	6.8	7.3	15.9	5.5	11.9	5.7	5.8	8.3	18.2
	$'000	12.6	21.1	1.1	1.5	3.5	2.0	3.6	19.1	2.3	3.8	6.3
	$/Kg	0.46	0.58	0.16	0.21	0.22	0.36	0.30	3.35	0.40	0.46	0.35
of which from:												
Morocco	Tonnes	10.8	8.6	6.8	7.3	15.5	5.3	10.6	5.3	5.8	8.3	...
	$'000	1.8	1.4	1.1	1.3	3.0	1.1	2.1	6.3	2.3	3.8	...
	$/Kg	0.17	0.16	0.16	0.18	0.19	0.21	0.20	1.19	0.40	0.46	...
Other countries	Tonnes	16.5	27.6	–	–	0.4	0.2	1.3	0.4	–	–	18.2
	$'000	10.8	19.7	–	0.2	0.5	0.9	1.5	12.8	–	–	6.3

Source: Statistica Annuale del Comercio con l'Estero to 1973, Statistica Mensile del Comercio con l'Estero thereafter

Notes: (a) Excludes wild thyme from 1974 figures for wild thyme are as follows:

		1974	1975	1976
TOTAL	Tonnes	8.0	4.1	8.6
	$'000	2.9	1.3	2.8
	$/Kg	0.36	0.32	0.33
Morocco	Tonnes	3.8	...	...
	$'000	1.7	...	...
	$/Kg	0.45	...	...
Yugoslavia	Tonnes	3.0	...	...
	$'000	0.8	...	...
	$/Kg	0.27	...	...
Hungary	Tonnes	1.2	...	...
	$'000	0.4	...	...
	$/Kg	0.33	...	...

– nil or negligible
... not available

Table 58

Thyme (crushed or ground): imports into Italy

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	0.1	0.2	–	0.1	–	–	0.5	2.9	0.9	4.2	1.9
	$'000	0.7	0.2	0.1	0.3	–	–	0.8	0.5	2.9	15.5	23.1
	$/Kg	7.00	1.00	4.48	3.00	–	–	1.60	0.17	3.22	3.69	12.16
of which from:												
Federal Republic of Germany	Tonnes	–	0.1	–	–	–	–	–	–	0.9	4.2	. . .
	$'000	–	0.1	–	–	–	–	–	–	2.9	15.5	. . .
	$/Kg	–	1.00	–	–	–	–	–	–	3.22	3.69	. . .
Morocco	Tonnes	–	–	–	–	–	–	0.4	2.9	–	–	. . .
	$'000	–	–	–	–	–	–	0.1	0.5	–	–	. . .
	$/Kg	–	–	–	–	–	–	0.25	0.17	–	–	. . .
France	Tonnes	–	–	–	0.1	–	–	–	–	–	–	. . .
	$'000	–	–	0.1	0.3	–	–	0.7	–	–	–	. . .
	$/Kg	–	–	4.48	3.00	–	–	23.83	–	–	–	. . .
Other countries	Tonnes	0.1	0.1	–	–	–	–	–	–	–	–	. . .
	$'000	0.7	0.1	–	–	–	–	–	–	–	–	. . .

Source: Statistica Annuale del Comercio con l'Estero to 1973, Statistica Mensile del Comercio con l'Estero thereafter

Notes: – nil or negligible
. . . not available

Table 59

Thyme (not crushed or ground): imports into Belgium/Luxembourg

		1966	1967	1968	1969	1970	1971	1972	1973	1974[a]	1975[a]	1976[a]
TOTAL	Tonnes	60.7	27.7	27.8	32.4	19.5	26.3	35.6	32.9	41.6	31.9	35.6
	$'000	62.0	19.0	12.4	13.2	12.6	19.3	32.3	43.1	45.6	39.6	35.4
	$/Kg	1.02	0.69	0.45	0.41	0.65	0.73	0.91	1.31	1.10	1.24	0.99

Source: Bulletin Mensuel du Commerce Extérieur, Belgium/Luxembourg

Note: (a) Excludes wild thyme for 1974 figures for wild thyme are as follows:

		1974	1975	1976
TOTAL	Tonnes	3.6	2.1	4.8
	$'000	8.1	2.9	3.9
	$/Kg	2.25	1.38	0.81

Table 60

Thyme (crushed or ground): imports into Belgium/Luxembourg

		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	Tonnes	1.8	1.2	1.5	0.4	2.2	1.0	0.4	5.5	5.5	2.6	3.3
	$'000	3.2	2.8	3.2	1.4	4.5	5.7	3.8	10.9	19.5	12.3	2.8
	$/Kg	1.78	2.33	2.13	3.50	2.05	5.70	9.50	1.98	3.55	4.73	0.85

Source: Bulletin Mensuel due Commerce Extérieur Belgium/Luxembourg

References and Bibliography

There is an extensive literature on herbs, but most of the published information emphasises historical and legendary aspects, whilst medicinal uses and recipes are extensively treated. Most of the books contain very little or negligible amounts of marketing information, whilst botanical information is sometimes inaccurate. The following works have proved useful in the compilation of this report.

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Appendix A

Addresses of trade associations and herb trading and processing companies

The following list gives the names of some of the major companies which trade in, or are processors of herbs, as well as the trade associations which supply such names. As far as possible the specific function of the companies has been indicated eg importer/dealer, agent/broker, grinder and processor. The list should not be regarded as exhaustive. Inclusion in the list does not imply that the Tropical Products Institute has any knowledge of the financial standing of the company.

BELGIUM

Aciens Etablissements Blieck Breughelstraat 25-27-29 2000 Antwerpen	Importer
Denolin SA 47 rue du Chateau 1420 Braine-l'Alleud	
Donck Food 2620 Hemiksen Antwerp	Importer
Robert Meyskens S.p.r.l. 140 rue du Marais Quievrain	Importer/dealer
Produits Top S.p.r.l. Rue de l'Avenir, 43 – 45 Brussels 1080	Processor/packer

FRANCE

Syndicat National des drognes, epices, herboristeries et produits exotiques 29 rue la Canebiere 13001 Marseille	Trade association
Union interprofessionelle de poivre et des epices 3 rue de Copenhague 75008 Paris	Trade association

Ets Maurice Daniel 84 – 88 Boulevard des Plombieres Marseille	Dealer
Rubens Denery SA 10r rue de Rouet 13008 Marseille	Dealer
Ets Ducros et Fils Departement VRAC 26170 Buis-les-Baronnies	Importer/processor
Etablissements Ducros 84170 Monteux	Processor
Ming SA Zone Industrielle Ouest 91160 Longjumeau	Processor
Socoherb SA 30 rue de la Bibliotheque 13001 Marseille	Dealer
Ricard et Frappa 1 rue Joseph-Autran 13006 Marseille	Dealer

FEDERAL REPUBLIC OF GERMANY

Waren-Verein de Hamburger Börse e V 2 Hamburg 1, Plan 5	Trade association
Fachverband der Gewürzindustrie e V Kölner Strasse 157 5300 Bonn-Bad Godesberg	Trade association
Heinrich Ambrosius Mittelweg 118 2000 Hamburg 13	Importer/dealer
Cornehls und Bosse 2000 Hamburg 11 Bei den Mühren 91	Broker
Edeka Zentrale Aktengesellschaft 2000 Hamburg 60 New-York-Ring 6	Importer and processor
Fuchs-Gewurze GmbH 4503 Dissen T W Westring 15 – 17	Importer/processor
Gebring und Neiweiser 4800 Bielefeld 1 Sudbrackstr 37a – 43	Importer/processor
Paul Muggenburg Wandelenweg 24 2000 Hamburg 1	Importer/dealer

Ostmann-Gewürze
4800 Bielefeld
Markstr 11
Processor

Ubena-Gewürzindustrie Runker & Frischen
28 Bremen 1
Hans-Bredowstr 36
Importer/processor

E H Worlee and Co.
Bellevue 7–8
D-2000 Hamburg 60
Importer/dealer

ITALY

Associazione Commercio Caffe,
Droghe e Coloniali (ASSOCAF)
Via Mercanzia 4
Genoa
Trade association

D Co Ulrich
Via Muratori 3
10126 Torino
Trade association

JAPAN

All Nippon Spice Association
13–4 Mishuku 1-chome
Setagaya-ku, Tokyo
Trade association

Dainan Boeki Kaisha Ltd
39 Minami Kyuhoji-machi 4-chome
Higashi-ku, Osaka
Importer

House Food Co. Ltd
2, 2-chome Nishi Hatchobori
Chuo-ku, Tokyo
Importer/processor

K Kobayashi & Co. Ltd
Boeki Bldg, 123 Higashi-machi
Ikuta-ku, Kobe
Importer/dealer

The Lion Dentifrice Co. Ltd
3–7 Honjo 1-chome
Sumida-ku, Tokyo
Importer/processor

Mitsubishi Shoji Kaisha Ltd
20, 2-chome Marunouchi
Chiyoda-ku, Tokyo
Importer/Trading house

Mitsui & Co. Ltd
2–1, 1-chome, Ohtemachi
Chiyoda-ku, Tokyo
Importer/Trading house

Nippon Spice Co. Ltd
4–29, Numabukuro, Nakano-ku
Tokyo
Processor

S B Shokuhin Co. Ltd
32, 3-chome Nihonbashi Kabuto-cho
Chuo-ku, Tokyo
Importer/processor

THE NETHERLANDS

Nederlandsche-Vereeniging voor den Specerijhandel c/o Internatio-Producten BV P O B 253, Van Vollenhoven Straat 3 Rotterdam	Trade association
G Buttner and Co. Henegouwenlaan 43c Rotterdam	Broker/agent
Catz International Westersingel 96 P O Box 180, Rotterdam	Importer/dealer
Euroma Ten Doesschate BV Kloosterweg, Postbus 4 Wapenveld (Gld)	Packer/processor
India Specerijen Antwerpsesteenweg 320a 2140 Westmalle	Importer/dealer
M P van Jinnelt Prins Hendrikkade 152 Amsterdam	Broker/agent
Kolle and Co. PC Hooftstraat 43 Amsterdam-Z	Broker/agent
Mirandolle Voüte and Co. BV Westermarke 2 Amsterdam 1002	Importer/dealer
Erven G van Sillevoldt NV Honingderdijk 49 – 57 Rotterdam 16	Packer/processor

SWITZERLAND

Dixa AG Stationstrasse 39a St Gallen 9014	Importer/processor
J Carl Fridlin Lobernstrasse 7 CH-6300 Zug	Importer/processor
Gastpar et Cie (Gewürzmühle Lichtensteig) AG, CH-9620, Lichtensteig	Importer/processor
Migros-Genossenschaftsbund Limmastrasse 152 8031 Zurich	Importer/processor

THE UNITED KINGDOM

Blyth Greene Jourdain and Co. Ltd — Importer/dealer
Plantation House
Mincing Lane
London EC3M 3EE

British Pepper and Spice Co. Ltd — Importer/processor
86–90 Hermitage Walk
London E1 9LW

Brome and Schimmer Ltd — Importer
Unit 3, Industrial Estate
Great Bridge Street
Romsey, Hants

Bush, Boake Allen Ltd — Importer/processor
Blackhorse Lane
London E17 5QP

C C Spice UK Ltd — Importer/processor
Faraday Road
Astmoor
Runcorn
Cheshire WA7 1PE

Joseph Flach — Importer/dealer
140 Falkland Road
London N8

McCormick Foods (UK) Ltd — Importer/processor
Rossmore Road East
Ellesmere Port, Wirral
Merseyside L65 3DA

R Sarant and Co. Ltd — Importer/dealer
Priestley Road
Basingstoke
Hants RG24 9PU

Schwartz Spices Ltd — Importer/processor
Castle House
71/75 Desborough Road
High Wycombe
Bucks

THE UNITED STATES OF AMERICA

American Spice Trade Association (ASTA) — Trade association
Sylvan Avenue
Englewood Cliffs
NJ 07

Berger & Plate Company — Importer/dealer
One California Street
San Francisco, CA 94111

California Commodities Corporation — Importer/dealer
320 California Street
San Francisco, CA 94104

Champon, L A & Company Inc. 230 West 41 Street New York, NY 10036	Broker/agent
Crescent Manufacturing Company 25 South Hanford Street Seattle, WA 98134	Grinder/processor/packer
Elton, John H Inc. 118–21 Queens Boulevard Forest Hills, NY 11375	Broker/agent
French, R T Company One Mustard Street Rochester, NY 14609	Grinder/processor/packer
Fritzsche Dodge & Olcott Inc. 76 Ninth Avenue New York, NY 10011	Grinder/processor/packer
Furth, Louis, Inc. 170 Stewart Avenue Brooklyn, NY 11237	Importer/dealer
Glidden Durkee Division of SCM Corporation 1001 Eighth Avenue Bethlehem, PA 180118	Grinder/processor/packer
Golombeck, Morris, J, Inc. 960 Franklin Avenue Brooklyn, NY 11225	Importer/dealer
Ireland, B C, Inc. Post Office Box 2047 San Francisco, CA 94126 and 214 Front Street San Francisco, CA 94111	Broker/agent
Kalamazoo Spice Extraction Company 3711 West Main Post Office Box 511 Kalamazoo, MI 49005	Grinder/processor/packer
Manheimer, J, Inc. 35–02 48th Avenue Long Island City, NY 11101	Broker/agent
McLintock, W L Co., Inc. 214 Front Street San Francisco, CA 94111	Broker/agent
McCormick & Company Inc. 11350 McCormick Road Hunt Valley, MD 21031	Grinder/processor/packer
Meer Corporation 9500 Railroad Avenue North Bergen, NJ 07047	Grinder/processor/packer

Mueller, Ludwig, Co., Inc. 21 West Street New York, NY 10006	Broker/agent
Mincing Trading Corp. 25 Broadway New York, NY 10004	Importer/dealer
Sauer, C F Company 2000 W Broad Street Richmond, VA 23220	Grinder/processor/packer
Sayia, A A & Company Inc. Post Office Box M9 One Newark Street Hoboken, NJ 07030	Broker/agent
Scott, E L & Company Inc. One World Trade Center Suite 2347 New York, NY 10048	Broker/agent
Spice Islands Inc. Division of Specialty Brands, Inc. 100 E Grand Avenue S San Francisco, CA 94080	Grinder/processor/packer
Stange Co. 342 North Western Avenue Chicago, IL 60612	Grinder/processor/packer
Von Scheven, Inc. 210 California Street San Francisco, CA 94111	Importer/dealer
Uhe, George, Co., Inc. 76 Ninth Avenue New York, NY 10011	Broker/agent

Appendix B

Sources of information regarding specifications

For details of standards and quality regulations for the major importing countries the following organisations should be able to provide detailed information, where this is available. Trade associations listed in Appendix A should also be able to provide assistance.

International Standards Organisation (ISO)
1, rue de Varembe
Case Postale 56
CH 1211 Geneva 20
Switzerland

The Secretariat for the ISO on spices and condiments is:

The Indian Standards Institution
Manap Bhavan
9 Bahadur Shah Zatar Marg
New Delhi 110001
India

THE FEDERAL REPUBLIC OF GERMANY

DIN Deutsches Institut für Normung
Burggrafenstrasse 4 – 7
Postfach 1107
D-1000 Berlin 30

FRANCE

Association Francais de Normalisation (AFNOR)
(Commission des Epices et Aromates)
Tour d'Europe
Cedex 7
92080 Paris – La Defense

ITALY

Ente Nazionale Italiano di Unificazione
Piazza Armando Diaz 2
120123 Milano

JAPAN

JISC
Ministry of International Trade and Industry
1-3-1 Kasumigaseki, Chiyoda-ku
Tokyo

NETHERLANDS

Nederlands Normalisatie-Instituut
Polakweg 5
Rijswijk

THE UNITED KINGDOM

British Standards Institution
2 Park St
London W1A 2BS

THE UNITED STATES OF AMERICA

Food and Drug Administration (FDA)
Guidelines and Compliance Branch
Bureau of Foods (HFF-312)
200 C Street, SW
Washington DC 20204

American Spice Trade Association Inc (ASTA)
580 Sylvan Avenue, P O B 1267
Englewood Cliffs
NJ 07632

American National Standards Institute
1430 Broadway
New York
NY 10018

Appendix C

Tariffs

According to the latest data available at the time of writing this report, import duties on herbs (often classified as 'other spices') were charged as follows:

Western Europe

Countries applying the duties	BTN number, rates of duty as of July 1976 09.10 other spices	
	M.f.n[1]	G.S.P[2]
EEC[3]	Thyme, neither crushed nor ground – wild : free – other: 14% Thyme, crushed or ground : 14% Bay leaves : 14% Other spices, including mixtures – neither crushed nor ground : 20% – crushed or ground : 25%	Other spices, including mixtures – neither crushed nor ground : 11% (1977 – 4%) – crushed or ground : 13% (1977 – 5%)
Sweden	Free	Free
Spain	Thyme and Bay leaves : free Saffron : free Mixed spices : 22.5%	
Switzerland	Thyme and Bay leaves : SF 10/100 Kg Other spices – not processed : SF 12.5/100 Kg – processed : SF 50/100 Kg	
Austria	Thyme and Bay leaves Unground, in single packs ⩽1 Kg : 21% otherwise packed : 14% Ground or crushed, in single packs ⩽1 Kg : 30% otherwise packed : 20%	Thyme and bay leaves – unground : 8% – ground or crushed : 12%
Finland	Free	Free
Norway	Thyme : free Bay leaves : free	

Heading number	Article		Rates of duty	
			Preferential tariff	General tariff
	Basil:			
161.03	– Crude or not manufactured		Free	Free
161.05	– Other	ad val	10%	25%
161.31	Dill	ad val	5%	25%
	Laurel (bay) leaves:			
161.39	– Crude or not manufactured		Free	Free
161.41	– Other	ad val	5%	25%
	Marjoram:			
161.51	– Crude or not manufactured		Free	Free
*161.53	– Other	ad val	7.5%	25%
	Mint leaves:			
161.55	– Crude or not manufactured		Free	Free
161.57	– Other	ad val	7.5%	25%
	Origanum:			
161.67	– Crude or not manufactured		Free	Free
161.69	– Other	ad val	7.5%	25%
	Parsley:			
161.73	– Crude or not manufactured		Free	Free
161.75	– Other	ad val	15%	20%
	Rosemary:			
161.90	– Crude or not manufactured		Free	Free
161.92	– Other	ad val	7.5%	25%
	Sage:			
161.94	– Not ground	per lb	0.5c	1c
161.96	– Ground or rubbed	per lb	1.5c	3c
	Savory:			
162.01	– Crude or not manufactured		Free	Free
162.03	– Other	ad val	7.5%	25%
	Tarragon:			
162.05	– Crude or not manufactured		Free	Free
162.07	– Other	ad val	7.5%	25%
	Thyme:			
162.09	– Crude or not manufactured		Free	Free
162.11	– Other	ad val	7.5%	25%
162.15	Mixed spices, and spices, and spice seeds not specially provided for	ad val	7.5%	25%

Other countries

Countries applying the duties	BTN number, rates of duty as of July 1976 09.10 other spices		
	M.f.n[1]		G.S.P[2]
Canada	Other spices – unground – ground	: 5% : 7.5%	free
Japan	Other spices, put up for sale by retail Other spices, not put up for sale by retail – unground and unmixed – ground or mixed	: 10% : free : 5%	free
Australia	free		free
New Zealand	free		free
USSR	free		free
Democratic Republic of Germany	not available		not available
Poland	20%		
Yugoslavia	5%		

Notes: [1] M.f.n. Duty rates applicable to imported goods originating in countries signatories to the General Agreement on Tariffs and Trade or with which agreements have been concluded containing the most-favoured-nation tariff.

[2] GSP Generalised System of Preferences under which most import duties on spices from developing countries are totally suspended. African, Caribbean and Pacific Countries (ACP), under the Lome Convention enjoy duty-free entry into the EEC for all spice products.

[3] EEC countries: Belgium/Luxembourg, Denmark, The Federal Republic of Germany, France, Ireland, Italy, The Netherlands, the United Kingdom.

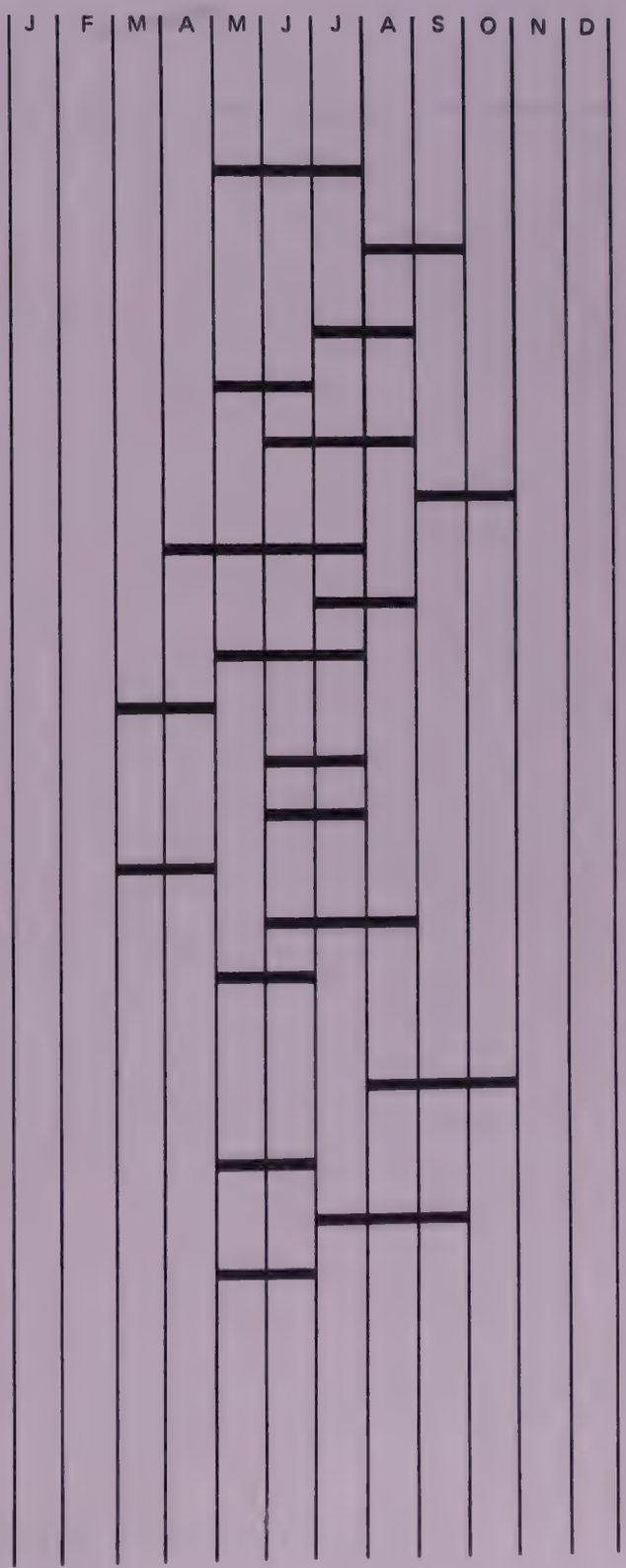
Source: Bulletin International des Douanes 1975 – 76

Appendix D

Major sources and peak harvest months for culinary herbs

Herb	Major sources
Basil	France, Italy, Egypt, USA
Bay (laurel) leaves	Turkey, Yugoslavia Greece
	Morocco, Portugal
Celery seed	France
	India
Chervil	France
Dill herb	Europe, USA
Dill seed	India
Marjoram	Europe, Egypt
	Chile
Mint	Europe, Egypt
Oregano	Greece, Italy
	Mexico
Parsley	USA, Europe
Rosemary	Yugoslavia, France, Spain, Portugal, North Africa
Sage	Yugoslavia, Albania
Savory	France, Spain
Tarragon	France
Thyme	France, Spain

Peak harvest months



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Source: Discussions with trade

Printed in England for Her Majesty's Stationery Office by Hobbs the Printers of Southampton
(88) Dd0574723 K/28 4/79 G3313

Tropical Products Institute

122

The processing of banana products for food use

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bruary 1979

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Ministry of Overseas Development

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Tropical Products Institute
ISBN: 0 85954 098 7

Summaries

SUMMARY

The major food products made from bananas are canned or quick frozen puree, dried figs, powder, flour, flakes, chips/crisps, canned slices, beverages and jam. This report reviews published information taken from selected literature on the methods used for processing bananas and includes a bibliography of other published work on the subject.

RESUMÉ

Les principaux produits alimentaires fabriqués à partir des bananes sont les suivants: purées en conserve ou surgelées, fruits secs, poudre, farine, flocons, chips et croustilles, tranches en conserve, boissons et confiture. L'auteur passe en revue les informations publiées dans des ouvrages choisis sur les méthodes employées pour la transformation des bananes et présente une bibliographie contenant d'autres ouvrages publiés sur le sujet.

RESUMEN

Los principales productos alimenticios hechos de plátanos son: puré en conserva o congelado rápidamente, higos secos, polvos, harina, copos, frituras en trocitos o rodajitas, rodajas enlatadas, bebidas y mermelada. Este informe pasa revista a la información publicada, tomada de literatura escogida, sobre los métodos empleados en la elaboración de productos de plátanos, y contiene una bibliografía de otras obras publicadas sobre la materia.

The processing of banana products for food use

INTRODUCTION

This report covers the processing of banana and is complementary to the report of the Tropical Products Institute G103, *The international market for banana products for food use* by R. J. Wilson (1975).

Considerable quantities of bananas, surplus to the requirements of the fresh fruit trade, are available for processing in all the major banana exporting countries of the world. The quantities of fresh bananas processed however, have been insignificant in comparison with the international trade in fresh fruit, and at the present time processing does not appear to provide a major outlet for disposal of surpluses. The total volume processed in the world probably does not exceed 100,000 tonnes of fresh fruit per annum and of this quantity products entering international trade account for not more than 50,000 tonnes. Interest in finding ways of utilising these surpluses has resulted in a great deal of research work being directed to this problem, but unfortunately large-scale development of banana products has been handicapped by the high cost of processing and, of more importance, lack of markets. There are also problems inherent in the fruit since it is very susceptible to flavour deterioration and discolouration when processed.

BANANA PUREE

Banana puree is produced by pulping the peeled fruits and preserving the resultant puree by one of the following methods:

(i) Aseptic canning;
(ii) Acidification followed by normal canning;
(iii) Quick-freezing.

The most acceptable product with regard to flavour is that produced by quick-freezing in Mexico and Honduras, but sales of this type of puree are confined to the United States market because of the high cost of transporting the product.

The bulk of the world's banana puree is processed by the United Brands Company in a modern factory at La Lima in Honduras by the Martin Aseptic Canning technique. The puree is prepared from the successful banana cultivar 'Valery'. The fruit is picked green and ripened artificially under controlled conditions.

The process has been described by Lawler (1967) and by Northcutt and Gemmill (1957). The latter authors described the process which was formerly used by the United Fruit Company (now United Brands Company) when they operated in the Dominican Republic.

After reaching full ripeness the fruit is conveyed from the ripening rooms, washed in water to remove dirt and spray residues, inspected and any substandard fruit removed. A further spray washing is carried out using chlorinated water. After

peeling by hand, the fruit is passed into a special pump, which forces the bananas through a plate with ¼ inch holes against a back pressure valve. The pulp is then successively passed into a homogenizer followed by a centrifugal deaerator and finally into a recovery tank held under a vacuum of 29 inches. The removal of air from the tissues prevents oxidative colour changes taking place.

The deaerated, finely homogenised pulp is then passed into a series of scraped surface heat exchangers where it is flash sterilised to an F_O value of 4 and finally cooled to 1.6° C using a cooling solution of chilled glycol-water. The cooled puree is then aseptically packed into steam sterilised cans and closed.

The canning line can handle up to twenty-one No. 10 cans per minute. The puree is also packed (using a special vacuum filling technique) into 55 gallon plastic-lined metal drums. Two filling units operate packing fifteen drums per hour. The commercial process produces a banana puree which is said to retain the flavour, colour and other characteristics of the fresh fruit for more than one year when stored at room temperature.

The initial stages of the process for the production of quick-frozen puree are similar to those used to produce canned aseptic puree. After passing through the heat exchangers the enzyme-inactivated puree is filled into 40 lb fibre-board containers and passed through a tunnel freezer at −37° C. Facilities are available to freeze eight tons of puree per day in this plant.

A similar plant for quick-frozen puree operates in Texas using Mexican bananas. The product is blast frozen at −35° C and is packed in either 40 lb fibre-board containers, or in 30 lb cans. The freezer capacity of this plant is reported to be about 100 tons per day.

Brekke *et al.* (1969) and Tonaki *et al.* (1973) have described an alternative method for preparing frozen puree. The bananas are peeled and immersed for three minutes in a 1.25 per cent solution of sodium bisulphite. The fruit is then milled through a ⅛ inch screen to give a coarse puree. The puree is then pumped to a plate heat exchanger and heated quickly to 94° C held for two minutes and then cooled rapidly to 30° C. The cooled puree is fed from the exchanger into a paddle finisher fitted with a 0.033 inch screen which removes seeds and some fibrous material. The puree is then pumped to a tank and citric acid added at the rate of 100g per 100 lb puree. Potassium sorbate is also added at a concentration of 200 ppm to inhibit spoilage by yeasts and moulds. The puree is then filled into suitable containers and stored at either a refrigeration temperature of 7° C or frozen at −18° C. Low temperature storage is necessary because the product is not sterile microbiologically. The process does however allow a processor or baker to prepare a large quantity of puree only two or three times a year and hold it in storage until required.

Small quantities of puree have also been produced in Australia, the Republic of South Africa, Brazil and Jamaica, by acidification followed by normal canning procedures to obtain a sterile pack. Guyer and Erickson (1954) successfully developed the first method for processing an acidified banana puree. The fruit is first peeled, attention being given to the removal of all peel rag and decayed portions which cause off-coloured puree. The peeled fruits are then blanched whole in steam or boiling water (or a combination of both) until a fruit centre temperature of 88° C is reached; this usually takes between six and eight minutes (medium-sized fruit). The fruit is then comminuted. Citric acid and sugar may be added during or after comminution, the quantities added being dependent upon an analysis of the fruit used, but in all cases the pH must be brought down to a value of between 4.1 and 4.3. The sugar is added to bring the concentration in the final puree to between 30 and 35 per cent which masks the slight citric acid flavour caused by the acidification.

The puree is then heated to 99° C and the cans filled hot, closed, inverted and held for five minutes to sterilize the lids, after which they are cooled to 38° C as quickly as possible in running water. In order to obtain a high quality product the whole operation from peeling to sealing the cans must be carried out as quickly as possible.

CANNED BANANA SLICES

Canned banana slices are packed in the United Brands Company plant in Honduras under the Chiquita label; the process has been described by Lawler (1967). After washing, inspection and peeling the fruit is conveyed to an Urschel cutter. From this machine 5/16 inch slices discharge onto a stainless steel table for manual filling into No. 10 cans through openings in the table. The cans then move via the conveyor to the sugar syruper and seamer. Sterilisation takes place as the cans move through water at 100° C on an open mesh metal belt. There is no mention in this report of any addition of citric acid or ascorbic acid to the product. However, the pH must be reduced in such a process to 4.2 in order to achieve sterility. It has been noted however, that these two acids are listed as ingredients on the labels of this canned product.

BANANA FIGS

Banana figs or fingers consist of the whole peeled fruit which have been carefully dried so as to retain their shape, or of dried halves or slices. The processing methods vary widely from the very primitive, where fruit is peeled and simply left on the ground to dry in the sun to more sophisticated methods using sulphur dioxide or solutions of sodium metabisulphite on the fruit (to prevent discolouration), followed by drying under controlled conditions in small cabinet dryers, or other suitable drying chambers. It has recently been reported Anon (1978) that a solar collector has been installed providing supplementary heating for drying bananas.

Raw material

For the successful production of dried banana figs, the fruit should be fully mature but not over-ripe. The sugar content must be as high as possible, otherwise, the final product is liable to be tough and lacking in flavour (Reader, 1950; Kay, 1967). If over-ripe fruit is used, the figs are often very sticky and dark in colour.

Harvesting and ripening

The best results are obtained if the bananas are harvested green (at the three-quarter full ripe stage) and ripened at the drying plant. Ripening normally takes from four to seven days and the fruit is ready for processing when it has acquired a uniform yellow colour but is still firm, with a sugar content of about 19.5 per cent.

Washing

After ripening, the bananas are separated from the stems and the hands of fruit washed thoroughly in tanks of clean water or by passing the fruit on a conveyor through sprays of water. Washing removes fungicide and other spray residues, soil, etc from the skins and prevents any carry over during peeling.

Peeling

This operation is usually carried out by hand although a machine does exist for peeling ripe fruit. The bananas are separated from the hands and peeled by hand with stainless steel knives. The machine peeler developed by Black (1974) in Queensland, Austrialia, is capable of peeling 1,200 lb of fruit per hour and uses two operators to feed the fruit into the machine.

Sulphuring

Most processors treat the peeled fruit with sulphur dioxide prior to drying, this reduces discolouration of the fruit during drying. Sulphuring is carried out either by dipping the fruit in a 3 per cent solution of sulphurous acid as recommended by Loesecke (1955) or by exposing the fruit to burning sulphur, at a sulphur dioxide concentration of between 1.0 and 1.6 per cent for 15 minutes (Savage and Arthur, 1935).

Drying

The fruit should be dried immediately after sulphuring. Drying bananas does not present any difficulties and many types of drying chambers have been suggested as being suitable. Loesecke (1955) claimed that halved fruits could be dried in a cabinet dryer at 65° to 82°C for 7 to 10 hours to give a final moisture content of 8 to 15 per cent. Roudier and Lavollay (1945) describe in detail both the sulphur kilns and the various drying chambers but give no quantitative information on times or temperatures. Dupaigne (1967) in discussing the optimum temperature to be used for the production of banana figs suggests that good results are obtained by exposing the fruit to a temperature not exceeding 72°C. Gooding (1958) reported that in India bananas were being successfully dried to a moisture content of 15 to 18 per cent in cross-flow cabinets at an initial temperature of 75°C which was finally slowly lowered to 60°C.

In Ecuador (Anon, 1966a) lower temperatures are reported to be used. The fruit is normally processed in counter-flow or cross-current tunnel driers and the temperatures of the air at the inlet and outlet of the tunnel are 60°C and 40°C respectively. The time of drying at these temperatures is stated to be 24 hours, bringing the figs down to an 18 per cent moisture content. The reported yields of dried figs from bananas on the stem range from 12 to 17 per cent.

Packing

After drying, the figs are sorted and size graded before packing. Some processors cut the ends so as to produce a more uniform and attractive product. The fruit is then packed either in bulk in fibre-board or wooden cases lined with polythene, containing about 28 lb of figs. Smaller 8 oz packets of figs are wrapped in cellophane or polythene for retail sale, and packed in fibre-board cartons containing 50 packets. The packaged banana figs should be stored in dry conditions and precautions taken to avoid insect infestation or contamination from rodents. Some processors fumigate the figs with methyl bromide as a precaution against insect infestation.

An improved method of drying banana by using the process of osmotic dehydration has been described by Brekke and Ponting (1970) and Ponting (1973). Fully ripe bananas are peeled, and cut into ¼ inch slices using a grid of stainless steel wire spaced ¼ inch apart. The slices are then placed in a 67° to 70° Brix sugar syrup in a stainless steel tank. The bananas float on top of this solution and to prevent this, a circular sheet of aluminium or stainless steel is placed on top of the fresh fruit to keep the bananas fully covered and below the surface of the syrup.

As water is osmotically withdrawn from the banana slices, the syrup becomes diluted. Further quantities of dry sugar are added in order to maintain the 67° to 70° Brix concentration. The rate of 'osmo-drying' can be increased by raising the temperature to about 50°C. For ¼ inch slices the period of immersion is 8 to 10 hours although it can be increased beyond this time to remove more water from the fruit if desired.

The slices are removed from the syrup and allowed to drain. They are then spread on trays which are covered with aluminium foil strips. The trays are then sprayed with water to wash excess syrup off the surface of the fruit and set at an angle of 5° or 10° allowing water to drain off.

The tray is then placed into a vacuum shelf dryer and the bananas, with the foil, gently slide off from the tray on to the shelf. Shelf temperature is maintained at 65° to 70°C at a vacuum of 10 mm Hg, at which pressure the slices puff up to two to three times their original volume. After 5 hours drying, the temperature is lowered to between 21° and 24°C and the vacuum released. Osmo-vac dried bananas made in this manner contain 2.5 per cent moisture or less. They are crisp, porous and have a fair banana flavour.

BANANA POWDER

Banana powder is prepared from fully ripe bananas. After washing and peeling, the fruit is converted into a paste by passing first through a chopper, then through a colloid mill. It is preferable to add a 1 or 2 per cent solution of sodium metabisulphite before it is dried in order to improve the colour of the final product. According to Loesecke (1955) both the powder and flour may be prepared by spray drying but the process is not favoured because entrainment losses are rather high, although Mizrahi *et al.* (1967) suggested that additions of soya protein could alleviate this problem.

Spray-drying

The pulp or slurry is passed by means of a variable speed pump to a turbine driven atomizer located at the top of the spray drying tower. The tower may consist of a large cylinder 20 to 25 feet in diameter and 25 to 30 feet high. Hot air is admitted near the top of the tower through a duct (4 square feet). The air is blown into the tower and then exhausted through suitable ducts about 5 feet from the bottom of the tower. The atomized slurry meeting the hot air is dried and falls to the bottom of the dryer. The air in the dryer in contact with the dried powder is maintained at 30° to 32°C and with a relative humidity not exceeding 30 per cent. A spray dryer of this size should be able to produce 150 lb of powder per hour. Yields in spray drying range from 8 to 11 per cent based on the fresh unprepared fruit cut from the stem.

Drum-drying

This is the preferred method of preparing banana powder because all the solids are recovered. The process is covered by a US Patent, Northcutt and Northcutt (1948). The pulp or slurry (see previous paragraph) is fed as a thick film to steam heated drums whose temperature is maintained between 170° and 174°C. The maximum temperature of the material on the drum should not exceed 94°C. The distance between the drums must be carefully adjusted to correspond to variations in the ripeness of the fruit. If they are not properly adjusted the product may come off the drums as a sticky mess, or it may be too crumbly. Drums rotate at between 3 and 12 revolutions per minute and before they have made one complete revolution the fruit pulp is sufficiently dry to be scraped off as a powder, by a 'doctor-blade'. The moisture content if reduced to 12 per cent by drum-drying and is then dried further in either a cabinet or tunnel-dryer at a temperature of 60°C to a moisture content of 2 per cent. The yield is about 13 per cent based on the fresh unpeeled fruit and the moisture varies from 2 to 5 per cent. The product can be kept fresh and crisp for over six months in thick polythene packets.

Foam-mat drying

It has been shown by Singhagajen and McBean (1968) that a high quality banana powder can also be prepared by using the relatively new technique of foam mat drying. Fully ripe Cavendish bananas were used in an experimental trial. The fruit was peeled by hand and pulped into a food blender. A 5 per cent solution of sodium metabisulphite was added (to give 1,000 ppm SO_2 in final product) together with a glycerylmonostearate stabilizer, at the rate of 2 per cent of banana solids. The mixture was foamed in a Hobart mixer using a wire whip attachment at a temperature of 20° to 25°C. The maximum expansion of three times original volume occurred in 5 minutes. The stiff foam was then spread on wire mesh trays to a depth of ⅛ inch and dried in a cross-flow dehydrator for 30 minutes at 99°C followed by 30 minutes at 82°C and finally at 75°C until dry, with an average air speed of 1,000 feet per minute. Water rate loss was rapid during the experiment, at 99°C the water content fell from 80 per cent to 12.5 per cent in 15 minutes and then continued to fall for the next 3¾ hours until a final moisture content of 2 per cent was reached.

The resultant product was a free flowing powder with the characteristic odour and flavour of fresh fruit. It was, however, necessary to pack in moisture proof containers due to its hygroscopic nature. Under temperate storage conditions of 20° to 25° C, it remained acceptable for 9 to 12 months.

BANANA FLOUR

Banana flour in contrast to banana powder is prepared from unripe fruit and is therefore characterised by its high starch content.

The flour is often prepared by simply drying the peeled sliced unripe fruit in the sun or in simple cabinet dryers and then milling the dry slices into a fine powder. The flour prepared in this manner is often heavily infested with insects, sand and filth and is therefore of limited commercial value. The flour according to Loesecke (1955) can be prepared similarly to banana powder by pulping the fruit and drying the resultant paste in a drum-dryer or by spray drying the atomised pulp in a hot spray chamber.

The Ecuadoran banana industry investigated the possibility of producing banana flour on a commercial scale (Anon, 1966b). It is not known whether these methods are now being used in Ecuador but the following method for flour production was suggested in the feasibility study.

Raw material

The bananas should be harvested at the stage of maturity designated as three-quarter full and processed within 24 hours, as at this stage of development the fruit contains the right proportions of starch and sugar to make dehydration economic. If less mature fruit is used the resultant flour tastes slightly bitter and astringent due to the tannin content, while if more mature fruit is used, difficulty is experienced with dehydration.

Washing and peeling

On arrival at the processing plant the bananas are first separated by hand and then washed. Normally the fruit is first washed in cold water to remove spray residues and dirt from the skin, and then immersed in water at 40° to 45° C; sometimes the bananas are immersed in a third washing tank containing water at 70° to 75° C. The whole operation, however, is completed in 5 or 6 minutes. The hot water facilitates the removal of the peel from the unripe fruit, this operation is carried out by hand using stainless steel knives. The peeled bananas are cut ¼ inch thick and 1 inch in diameter.

Sulphuring

The pieces are transferred into a sulphur chamber and exposed to sulphur dioxide gas for from 20 to 25 minutes. This process preserves the colour and flavour of the product.

Drying

The sulphured slices are transferred to a counter-current tunnel dryer and dried to a moisture content of 8 per cent. This normally takes from 7 to 8 hours using inlet air temperatures of 75° C and exit temperatures of 45° C.

Flour preparation

The dried pieces are removed from the dryer and left to cool to the ambient temperature before being ground into a flour and then sifted through sieves. The type of mesh used for sieving the flour depends upon the grade and fineness of the flour required by a particular market.

Packing

Banana flour is hygroscopic and must be packed in moisture proof containers. Sacks lined with polythene are reported to be suitable.

Yield

It is estimated that 100 lb of peeled green bananas will produce 27 lb of banana flour with a moisture content of 8 per cent.

BANANA CHIPS OR CRISPS

Banana-chips or crisps are prepared in a number of countries by either drying thin unripe banana slices and frying the dried slices in an edible oil to give a product similar to potato crisps, or simply frying the thinly sliced green banana directly in an edible oil without any pre-drying treatment. Adeva *et al.* (1968) suggested the following processing method: unripe bananas are peeled and immediately immersed in a 500 ppm sodium metabisulphite solution for 15 minutes. The peeled sulphited fruits are then longitudinally cut in slices 1/16 to 1/8 inch thick in a Hobart slicer. The sliced bananas are again soaked in a 500 ppm solution of sodium metabisulphite for about one hour. The slices are then dropped into boiling water for 30 seconds and then into cold water for 5 seconds. The blanched enzyme inactivated banana slices are then dried on wire trays in a force draught oven at 70°C for from 3 to 4 hours. The slices at this stage have a moisture content of between 2 and 2.5 per cent. The dried slices are then deep fat fried in hydrogenated oil at 190°C to 200°C with 0.01 per cent butylated hydroxy toluene (BHT) then dusted with salt to taste. The finished products, packed in polyethylene bags and heat sealed were of good texture, colour and flavour, with good storage characteristics. Jain *et al.* (1962) and Bai and Rao (1969) suggested methods of improving banana chips/crisps produced in southern India. The processing method differed from the method used in the Philippines since the sliced bananas were not dried before frying. The basic method involved peeling the fruit and slicing 1/16 to 3/32 inch thick using a stainless steel slicer. The best product was prepared by soaking the slices for 10 minutes in a solution of 5 per cent sodium chloride and 0.5 per cent potassium metabisulphite. The treated slices were then drained and fried in a vegetable oil. The use of an antioxidant was found to improve the keeping quality. This was added to the fried crisps in the form of a dust coating containing 3.33 per cent salt, 0.01 per cent butylated hydroxy anisole, 0.002 per cent butylated hydroxy toluene and 0.004 per cent citric acid (percentages on the weight of the crisps). When packed in hermetically sealed containers and protected against light, the chips/crisps did not show any deterioration in quality during storage up to 28 weeks at 37°C. Similar experiments with ripe bananas did not yield chips/crisps of satisfactory quality.

BANANA JAM

Loesecke (1950) has described the preparation of banana jam. The jam is made by boiling equal quantities of fruit and sugar with additions of lemon juice and water until the setting point is reached. Lime juice or citric acid can be used to replace the lemon juice reducing the pH of the banana sugar mixture from 5.4 to 3.5.

Destang* has suggested that additions of pectin can improve the setting of the product. He has also suggested that over-ripe bananas can be used to prepare a banana jelly. The fruit is cut into one inch pieces and boiled for one hour in 60° Brix sugar syrup at a rate of 1 lb banana to 1 pint of syrup. This is then strained and the resultant clear solution boiled until the setting point is reached. Citric acid should also be added to suppress the pH to 3.5. Again pectin must be added to produce a good set. The flavour of the jelly is said to be superior to that of the jam.

*Private communication (1977) St Lucia, Product Chemistry Laboratory.

BANANA FLAKES

Banana flakes are small, straw coloured particles of dried banana which, if correctly prepared, taste very like the fresh fruit. The following method for their manufacture is reported to have been used in Brazil (Anon, 1943). The bananas were picked when three-quarters ripe and were first conditioned in a heated chamber for 6 to 12 hours and stored in a well-ventilated room for two to three days to complete the ripening process. The fruit was next peeled and then placed in a drum into which carbon dioxide gas was pumped to remove the oxygen from the fruit. The fruit was then whipped into a creamy pulp and pumped to a dehydrator where thin films of it were spread out on a large rotating cylinder heated to 181°C. The film, when dry, was scraped off the cylinder and broken up into flakes. These were allowed to stand in sealed cans until cool and finally packed in moisture-proof waxed paper cartons.

The Israeli workers, Samish and Coussin (1965) have investigated the possibility of producing flakes as a means of utilizing surplus bananas. Cavendish bananas were used for the experiment and dehydration was carried out on a pilot plant double drum dryer heated internally by steam.

The optimum operating conditions were found to be, drum distances 1.0 mm, retention time 51 seconds, a steam pressure of 42 lb per square inch and a drum surface temperature of 145°C. It was found essential to pre-treat the bananas before pulping in order to prevent darkening and flavour deterioration. The fully mature fruit was blanched in steam for five minutes and the pulp treated with sulphur dioxide. The most acceptable concentration of sulphur dioxide in the dried flakes was found to be between 500 and 550 ppm, which corresponds to 160 mg of sodium metabisulphite per 100 g of banana pulp. The keeping quality was satisfactory when the moisture was kept below 2.6 per cent and the product packed into cans under vacuum.

BANANA BEVERAGES

Pressing banana pulp without any preliminary treatment does not produce a juice. Dupaigne and Dalnic (1965) found that by extracting the pulp after treatment with pectinase a cloudy characteristic banana flavoured juice was obtained but this had a low viscosity. Mumyanganizi and Coppens (1974) working in Belgium simplified the process by extracting the juice from banana pulp after treating with lime (CaO), leaving for 15 minutes, then neutralising the lime with 6 N sulphuric acid. The lime eliminated the pectin in the pulp, making extraction of the juice easier using either presses or centrifuges. The process was said to produce a better juice than previously reported with yields up to 88 per cent. It was suggested that the juice could be used as a starting point for the production of local banana beers in African countries (Burundi, Zaire, Uganda and Rwanda) where banana beers have been traditionally produced for centuries. Futher work by Dupaigne (1974) using enzyme mixtures (polygalacturonase and pectin esterase) to break the pectin in the banana pulp showed that a good juice could also be obtained provided that the bananas used were ripe and could be processed rapidly.

Casimir and Jayaraman (1971) also describe a process for producing an acceptable drink, involving the following steps:

(i) Acidification of the pulp to a pH of 4.2 to 4.3;
(ii) Rapid heating in the absence of oxygen accompanied by tissue disintegration and enzymic inactivation;
(iii) Separation of fibre;
(iv) Diluting, centrifuging and sweetening, filling and spin cooking;
(v) Cooling.

The first two steps were carried out in one operation using a Pfaudler vacuum tumble blancher and the third step in a screening De Laval centrifuge or a Brown screw press. It was suggested by the authors that the drink could be blended with other tropical fruit juices or carbonated to produce a refreshing drink.

CONCLUSIONS

There has been a great deal of research into methods for producing acceptable banana products. However, none of the resultant products can compare in flavour, or characteristics, with the fresh fruit which is available throughout the year in most parts of the world.

This review covers the methods used for processing banana puree, figs, powder, flour, flakes, chips/crisps, canned slices, beverages and jams but does not deal with the alcoholic beverages such as beers, wines and liqueurs. However, the market is very small for these products and in the case of banana beer is now rapidly declining in favour of the standardised European type brews produced locally.

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Printed in England for Her Majesty's Stationery Office by Hobbs the Printers of Southampton
(172) Dd0574722 3,500 3/79 G3313

Tropical Products Institute

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Slaughter facilities for tropical conditions: A guide to the selection and costing of appropriate systems

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ril 1979

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Ministry of Overseas Development

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Tropical Products Institute
ISBN 0 85954 099 5

ACKNOWLEDGEMENTS

The authors would like to thank those in the meat industry who gave information without which this report could not have been completed. Particular thanks are due to Mr P. Whitely of Brook and Crowther Ltd and to Foster Refrigerator (UK) Ltd. Thanks are also due to colleagues at TPI, in particular Dr P. Street and Mr A. Jones of the Marketing and Industrial Economics Department.

Summaries

SUMMARY

Slaughter facilities for tropical conditions

This report is designed to facilitate investment decision making. It is intended for use by those concerned with upgrading and expanding slaughter facilities in tropical countries. The basis of the report is a series of physical and financial cost models. Factor costs pertinent to a particular developing country have been applied for purposes of analysis. However, the physical requirements of the models have been set out so that users of the report may apply factor costs appropriate to their own locality.

Cost models have been developed at four scales of throughput, expressed in terms of livestock units:

Model 1 15 livestock units a day
Model 2 60 livestock units a day
Model 3 155 livestock units a day
Model 4 275 livestock units a day

In all models the slaughter of cattle, smallstock and pigs has been allowed for. To convert these slaughterstock to a livestock unit equivalent basis, the following factors have been applied:

Cattle/buffalo each equivalent to 1.0 livestock unit;
Smallstock (sheep/goats) each equivalent to 0.2 livestock units;
Pigs each equivalent to 0.5 livestock units.

The scales of throughput selected, cover a range rising from the smallest capacity at which an abattoir of acceptable standard might be built to an upper limit at which, if the need to handle a larger throughput is envisaged, consideration should be given to a fully mechanised plant incorporating such activities as deboning and meat processing. In the design of these models no specific capability to meet export standards has been incorporated.

Slaughter and dressing methods are discussed including by-product recovery and treatment. As well as edible offals it is assumed that cattle hides and sheep skins would be recovered and air dried, while in the two largest models blood/bone meal would be produced. Consideration is given to the installation of chilling facilities in the form of three cold rooms in each of Models 2, 3 and 4 to enable carcases to be held before dispatch.

The technical aspects of the models are discussed in Appendix II, while in Appendix III items of equipment are listed for each of the models and in Appendix IV some British manufacturers of abattoir equipment are given.

Apart from levels of throughput, the most marked difference in these models is between Model 1 and the other three models. Model 1 has been developed to

incorporate a simpler design and technology appropriate to the needs of larger rural communities. No chilling facility has been allowed for in this model. The other three models represent slaughter facilities able to satisfy the needs of urban communities.

A methodology is discussed by which the financial performance of the cost models may be analysed. This shows how appropriate slaughter fees can be derived from knowledge of the costs of establishing and operating a slaughter facility. The discounted cash flow method has been used to analyse the cost models with a test discount rate of 10% applied as a notional rate of return and an assumed project life of 20 years.

It has been assumed that the management of the abattoirs provides a service in slaughtering the animals for which the farmer/butcher is charged a fee. The abattoir is assumed not to be involved in the purchase of livestock and/or the sale of meat. The slaughter fee is calculated by estimating that fee which would give a stream of annual revenue which discounted over 20 years at 10% would equate to the value of the costs of establishment and operation similarly discounted. In calculating the appropriate slaughter fee, allowance has been made for revenue to be received from sale of by-products recovered. It has been assumed that edible offals remain the property of the farmer/butcher but that cattle hides, sheep skins and, where produced, blood/bone meal would be sold by the abattoir management and receipts set against the slaughter fee charged.

With 250 days operation a year, the following slaughter fees would result:

Model 1	£2.07
Model 2	£2.35
Model 3	£2.08
Model 4	£1.81

These equate to slaughter fees for the particular types of slaughterstock as follows:

	Cattle	Smallstock	Pigs
Model 1	£2.07	£0.41	£1.03
Model 2	£2.35	£0.47	£1.18
Model 3	£2.08	£0.42	£1.04
Model 4	£1.81	£0.36	£0.91

The sensitivity of the performance of the cost models has been tested, particularly to assess the effect of variations in throughput and the effect of changes in the assumptions on the recovery and sale of by-products.

Reducing throughput to 80 and 60% of the level assumed in the basic cost model has considerable effect on the slaughter fee required to obtain a 10% rate of return. For example, for Model 1 the appropriate fee would rise to £2.49 and £3.21 respectively and for Model 4 to £2.37 and £3.17. Similarly, increasing throughput to 120% of the level assumed in the basic cost models would reduce the appropriate fee to £1.80 for Model 1 to £1.51 for Model 4.

Models 2 and 3 would be affected in the same manner by these changes.

The importance to the financial performance of the models of the assumptions relating to by-product recovery and sale are illustrated by, firstly, the effect of the case of no by-product recovery and sale and, secondly, by the effect of a 50% higher sale-price for cattle hides and sheep skins. In the first case, to compensate for the loss of revenue from by-product sales, the appropriate fee required to obtain a 10% rate of return would have to increase above that of the basic cost models within the range of 15% (Model 1) to 40% (Model 4). In the second case, a reduction in the fee of the order of 11% (Models 2 and 3) to 15% (Model 4) would be possible.

The effect of the provision of chilling facilities was tested for Model 2 only. By omitting this facility the appropriate slaughter fee would be reduced from £2.35 to £1.52. Thus the decision whether or not to include a chilling facility has a considerable effect on the scale of fees to be charged.

RÉSUMÉ

Installations d'abattage pour milieu tropical

L'objet du présent rapport est de faciliter la prise de décisions concernant les investissements. Il s'adresse aux personnes chargées de perfectionner et de développer les installations d'abattage dans les pays tropicaux. Il s'appuie sur une série de modèles de coûts physiques et financiers. Les coûts des facteurs particuliers à tel ou tel pays en développement ont été intégrés dans l'analyse. La formulation des spécifications physiques des modèles permettra aux utilisateurs de ce rapport, en tout état de cause, d'appliquer des côuts de facteurs conformes à leur environnement immédiat.

On a élaboré des modèles de coûts correspondant à quatre niveaux de production exprimés en nombre de pièces de bétail:

Modèle 1 15 pièces par jour
Modèle 2 60 pièces par jour
Modèle 3 155 pièces par jour
Modèle 4 275 pièces par jour

Tous les modèles ont pris en compte l'abattage du gros bétail, du petit bétail et des porcs. Pour rapporter ces bêtes abattues à un système d'unités équivalentes de pièces de bétail, on a utilisé les facteurs suivants:

Chaque pièce de gros bétail ou buffle équivaut à 1,0 pièce de bétail sur pied;
Chaque pièce de petit bétail (moutons ou boucs) équivaut à 0,2 pièce de bétail sur pied;
Chaque porc équivaut à 0, 5 pièce sur pied.

Les niveaux de production sélectionnés représentent un éventail allant de la plus petite capacité acceptable permettant de construire un abattoir jusqu'à la limite supérieure à laquelle, si on envisage de gérer une production plus importante, il faudra prévoir une installation entièrement mécanisée comprenant des activités comme le désossement et le traitement de la viande. Ces modèles ne prennent pas en compte le degré d'aptitude à satisfaire des normes d'exportation.

On traitera de l'abattage et des techniques de préparation, y compris la récupération et le traitement des sous-produits. On suppose qu'en plus des abats comestibles, les peaux de gros bétail et les peaux de mouton sont récupérées et soumises à un séchage à l'air libre, tandis que dans les deux modèles les plus importants, il y a production de farine de sang et/ou d'os. On tient compte de la présence éventuelle d'installations frigorifiques: trois pièces frigorifiques dans chacun des Modèles 2, 3 et 4, pour suspendre les carcasses avant expédition.

Les aspects techniques des modèles sont abordés à l'Annexe II, tandis que l'Annexe III répertorie les différents matériels pour chaque modèle et que l'Annexe IV donne la liste d'un certain nombre de fabricants britanniques de matériels pour abattoirs.

Les niveaux de production mis à part, la différence la plus évidente entre ces modèles est celle qui sépare le Modèle 1 d'une part, les trois autres modèles d'autre part. Le Modèle 1 a été conçu pour intégrer un projet et une technologie simples adaptés aux besoins de communatés rurales importantes. Ce modèle n'a pas pris en compte d'installation frigorifique. Les trois autres modèles prévoient des installations d'abattage aptes à répondre aux besoins des communautés urbaines.

On propose une méthode d'analyse des incidences financières des modèles de coûts. Elle révèle quelles pourraient être les taxes d'abattage auxquelles on pourrait raisonnablement s'attendre si l'on connaissait les coûts d'installation et d'entretien d'un

abattoir. On a utilisé la méthode du cash flow réduit pour analyser les modèles de coûts, avec un taux d'escompte d'essai de 10% envisagé comme un taux de profit supposé et avec une durée d'exploitation prévue de 20 ans.

On a supposé que l'exploitation des abattoirs offre un service d'abattage des animaux pour lequel l'agriculteur ou le boucher paie une taxe. On considère que l'abattoir ne joue aucun rôle dans l'achat de bétail sur pied et/ou dans la vente de la viande. La taxe d'abattage est calculée en estimant la taxe qui donnerait un flux de revenu annuel qui, réduit de 10% sur 20 ans, serait égale à la valeur des coûts d'installation et d'entretien réduite dans les mêmes proportions. Dans le calcul de la taxe d'abattage correspondante, on a pris en compte le revenu à tirer de la vente des sous-produits récupérés' On a prévu que les abats comestibles restent la propriété de l'agriculteur ou du boucher, mais que les peaux de gros bétail, les peaux de mouton et, le cas échéant, la farine de sang et/ou d'os seraient vendues par la direction de l'abattoir et les fonds reçus seraient mis en balance avec la taxe d'abattage perçue.

Sur 250 jours de fonctionnement par an, voici les taxes correspondant à chaque modèle:

Modèle 1 £2,07
Modèle 2 £2,35
Modèle 3 £2,09
Modèle 4 £1,81

Ces taxes sont à mettre en rapport avec les bêtes abattues dans chaque cas particulier:

	Gros bétail	Petit bétail	Porcs
Modèle 1	£2,07	£0,41	£1,03
Modèle 2	£2,35	£0,47	£1,18
Modèle 3	£2,08	£0,42	£1,04
Modèle 4	£1,81	£0,36	£0,91

On a testé les variations de réceptivité aux incidences des divers modèles de coûts, incidences liées notamment aux différentes productions et aux conséquences des changements d'hypothèses concernant la récupération et la vente des sous-produits.

Une réduction de la production à 80 et 60% du niveau prévu par le modèle de coût de base a des répercussions considérables sur la taxe d'abattage requise pour obtenir un taux de profit de 10%. Par exemple, dans le cas du Modèle 1, la taxe appropriée s'éleverait à £2,49 et £3,21, respectivement, et pour le Modèle 4, elle passerait à £2,37 et £3,17. De façon analogue, l'augmentation de la production à 120% du niveau prévu par les modèles de coût de base réduirait la taxe correspondante à £1,80 pour le Modèle 1 et £1,51 pour le Modèle 4.

Les Modèles 2 et 3 seraient affectés pareillement par ces fluctuations.

L'importance du point de vue financier pour les modèles des hypothèses relatives à la récuperation et à la vente des sous-produits est illustrée premièrement par les conséquences qu'aurait une absence de récupération et de vente de sous-produits et, deuxièmement, par les effets d'une augmentation de 50% du prix de vente des peaux du gros bétail et des peaux de mouton. Dans le premier cas, afin de compenser la perte de revenu liée à l'absence de vente de sous-produits, la taxe permettant de retirer un taux de profit de 10% devrait monter par rapport au taux prévu par les modèles de base, de 15% (Modèle 1) à 40% (Modèle 4). Dans le deuxième cas, une réduction de la taxe de l'ordre de 11% (Modèles 2 et 3) et 15% (Modèle 4) serait possible.

Les conséquences de l'existence d'installations frigorifiques n'ont été testées que dans le cas du Modèle 2. Si on fait l'economie de ces installations, la taxe d'abattage est réduite et passe de £2,35 à £1,52. La décision de prévoir ou non ce type d'installations a donc des répercussions très importantes sur les taxes perçues.

RESUMEN

Instalaciones de mataderos para condiciones tropicales

Este informe está destinado a facilitar la toma de decisiones relativas a la inversión a realizar. Está pensado para que sirva de orientación a quienes estén interesados en mejorar y ampliar instalaciones de mataderos en países tropicales. El informe tiene por base una serie de modelos de costes referidos a factores físicos y económicos. Para los fines de análisis se han aplicado índices de costos pertinentes a un país determinado en vías de desarrollo. No obstante, los requisitos físicos de los modelos se exponen de manera que los usuarios del informe puedan aplicar los factores de costos apropiados a su propia localidad.

Se han desarrollado modelos de costos referidos a cuatro escalas de capacidad, expresadas como unidades de ganado sacrificado:

Modelo 1 15 unidades de ganado por día
Modelo 2 60 unidades de ganado por día
Modelo 3 155 unidades de ganado por día
Modelo 4 275 unidades de ganado por día

En todos los modelos se ha tenido en cuenta la matanza de ganado mayor, ganado menor y cerdos. Para reducir este ganado de matanza a una base equivalente a unidades de ganado se han aplicado los factores siguientes:

Ganado mayor/búfalo equivalente cada res a 1,0 unidad de ganado;
Ganado menor (corderos/cabras) equivalente cada uno a 0,2 unidades de ganado;
Cerdos, equivalente cada uno a 0,5 unidades de ganado.

Las escalas de capacidad seleccionadas abarcan una amplitud que va desde la capacidad más pequeña a la cual podría construirse un matadero de unas normas aceptables, hasta un límite superior, al cual, si se tiene prevista la necesidad de contender con un número aún mayor de ganado sacrificado, debería pensarse en la posibilidad de instalar una planta totalmente mecanizada que incorporara actividades tales como las de deshuesamiento y preparación de carne. En el diseño de estos modelos no se ha incorporado ninguna capacidad específica de satisfacer normas de exportación.

Se discuten métodos de matanza y desuello, con inclusión de la recuperación y tratamiento de subproductos. Además de despojos comestibles, se supone que se recuperarán y secarán al aire las pieles del ganado vacuno y lanar, mientras que en los dos modelos más grandes se supone que se produciría harina de sangre y de huesos. En cada uno de los Modelos 2, 3 y 4 se considera la eventual instalación de cámaras de enfriamiento en forma de tres cámaras frigoríficas para que puedan retenerse allí las canales antes de su despacho.

Los aspectos técnicos de los modelos se tratan en el Apéndice II, mientras que en el Apéndice III se relacionan los equipos para cada uno de los modelos y en el Apéndice IV se facilitan los nombres de fabricantes británicos de equipos de mataderos.

Aparte los niveles de capacidad de producción, la diferencia más marcada en estos modelos está entre el Modelo 1 y los otros tres. El Modelo 1 ha sido desarrollado con vistas a incorporar un diseño y tecnología más sencillos, apropiados a las necesidades de grandes colectividades rurales. No se ha previsto en este modelo ninguna instalación de enfriamiento. Los otros tres modelos representan instalaciones de matanza capaces de satisfacer las necesidades de comunidades urbanas.

Se discute una metodología mediante la cual puede analizarse el rendimiento económico de los modelos de costos. Se pone de manifiesto cómo pueden constatarse los importes a cargar por la matanza, partiendo del conocimiento de los costos de establecer y explotar un matadero. Se ha empleado el método del 'cash flow' descontado actualizado para analizar los modelos de costos, aplicando un tipo de descuento del 10% como tasa nocional de beneficio y una vida supuesta del proyecto de 20 anos.

Se ha supuesto que la dirección de los mataderos presta un servicio por concepto de matanza, por cuyo servicio se carga un importe al ganadero/carnicero. Se supone que el matadero no se ocupará de la compra del ganado ni de la venta de la carne. El importe a cargar por la matanza se calcula estimando el importe que generaría una corriente de ingresos anuales que, descontados sobre un periodo de 20 años al 10%, resultarían iguales al valor de los gastos de establecimiento y explotación actulizados de manera similar. Al calcular el honorario que corresponde cargar por la matanza se han tenido en cuenta los ingresos que se percibirían de la venta de los subproductos recuperados. Se ha supuesto que los despojos comestibles siguen siendo propiedad del ganadero/carnicero, pero que las pieles de ganado mayor y menor y, donde se produzca, la harina de sangre/huesos serían vendidos por la dirección del matadero y los importes percibidos por este concepto aportarán una reducción del importe a cargar por la matanza.

Con 250 días de trabajo al año, los importes a cargar por concepto de matanza resultarían ser los siguientes:

Modelo 1 £2,07
Modelo 2 £2,35
Modelo 3 £2,08
Modelo 4 £1,81

Estos importes son iguales a los siguientes importes de matanza para los tipos particulares de ganado:

	Mayor	Menor	Cerdos
Modelo 1	£2,07	£0,41	£1,03
Modelo 2	£2,35	£0,47	£1,18
Modelo 3	£2,08	£0,42	£1,04
Modelo 4	£1,81	£0,36	£0,91

Se ha ensayado la sensibilidad del comportamiento de los modelos de costos, particularmente para constatar el efecto que tienen las variaciones de la capacidad y el efecto de los cambios de los valores supuestos en la recuperación y la venta de subproductos.

La reducción de la capacidad a 80 y 60% del nivel supuesto en el modelo de costos básicos tiene un efecto considerable en el monto que hay que cargar por concepto de matanza para obtener un beneficio del 10%. Por ejemplo, en el caso del Modelo 1 el honorario apropiado aumentaría a £2,49 y £3,21 respectivamente, y en el caso del Modelo 4 a £2,37 y £3,17. Análogamente, aumentando la capacidad a 120% del nivel supuesto en los modelos de costos básicos se reduciría el monto que habría que cargar a £1,80 para el Modelo 1 y a £1,51 para el Modelo 4.

Los Modelos 2 y 3 resultarían afectados de la misma manera por estos cambios.

La importancia que para el comportamiento económico de los modelos tienen las suposiciones referentes a la recuperación y venta de subproductos quedan ilustradas, primeramente, por el efecto que tiene el caso de no recuperarse ni venderse subproductos y, en segundo lugar, por el efecto que tendría el conseguir un precio de venta de las pieles de ganado vacuno y lanar 50% más elevado. En el primer caso, para compensar la pérdida de ingresos relativos a las ventas de subproductos, el importe que se necesitaría cargar para obtener una tasa de beneficios del 10% tendría que aumentarse por encima del de los modelos de costos básicos entre los límites de 15% (Modelo 1) a 40% (Modelo 4). En el segundo caso, sería posible una reducción de alrededor del 11% (Modelos 2 y 3) al 15% (Modelo 4).

El efecto de proveer instalaciones de enfriamiento sólo se ha ensayado para el Modelo 2. Omitiendo este servicio el importe a cargar por matanza, se reduciría a £1,52 desde £2,35. Así pues, la decisión de incluir o no una instalación de enfriamiento tiene un efecto considerable en la escala de tarifas a cargar.

Chapter 1

Scope and purpose of the report

INTRODUCTION

In many villages and small towns in developing countries the slaughter of animals to provide food for human consumption is commonly carried out in unsuitable buildings by untrained slaughtermen and butchers unaware of sanitary principles. Even in the larger towns and cities, where abattoirs have been specifically constructed to supply meat to the expanding centres of urban population, conditions are frequently unsatisfactory. Sanitary regulations, where they are in existence, are often over-looked, not enforced or are disregarded and consequently the health of the consumer and the meat handler is potentially at serious risk.

As measures are put into effect to remedy these defects in the sanitary conditions under which slaughter is carried out and to improve the efficiency with which the present livestock offtake is handled, the capacity of existing slaughter facilities will come under increasing pressure. Additional pressure on the adequacy of these facilities will appear as opportunities are realised for the higher rates of offtake which are possible through improved and expanded livestock industries.

At present the livestock industry in many developing countries operates at below potential levels of productivity. For instance, it has been shown that for cattle, which account for about two thirds of the world's production of animal protein, the mean annual output of protein as milk or meat from animals in Africa and the Far East is less than one tenth of that obtained from the average animal in Europe*. The retarded development of livestock in the tropics reflects poor genetic stock combined with a lack of sufficient knowledge of animal nutrition to enable suitable inputs to be used effectively.

To indicate the extent to which meat production and consumption vary between different parts of the world, present levels of meat production in relation to human population and *per capita* consumption of meat are shown in Tables 1 and 2 for various regions of the world categorised by income level and economic system. The difference in consumption between developing and developed countries reflects not only less efficient livestock industries but also the more general problem of lower levels of income. Further pressure on slaughter facilities will be exerted in many developing countries by the scope for the expansion of meat production; evident through growth in demand generated by rising *per capita* income and rates of population growth which are still at relatively high levels (2% per annum or more).

This domestic potential, including that of inter-regional trade within a country, may be supplemented in some cases by external demand for meat products. For a number of tropical countries, most notable in South America and Africa, an export trade in meat has developed. Satisfactory conditions of slaughter are vital if the products from these countries are to meet the standards set by the importing countries. Some

*Blaxter, K. L. (1975) Increasing output of animal production: Technical measures for increasing productivity. In: *Man, Food and Nutrition,* (ed. M. Rechciel) Cleveland, Ohio, CRC Press.

Table 1

World meat production

	Total meat production 1972 – 74 (million tons)	Human population	
		Millions	Rate of growth
World	107.4	4,043	2.0
Developed nations	53.4	762	0.9
of which USA	25.1	238	1.0
EEC	17.0	366	0.5
Oceania	3.4	17	1.7
Centrally planned countries	34.7	1,289	1.4
of which USSR	12.1	242	1.0
Developing countries	19.3	1,992	2.7
of which Africa	3.0	328	2.9
Latin America	10.4	333	2.8
Near East	3.4	201	2.6
Far East	2.3	1,126	2.9

Source: FAO, Intergovernmental Group on Meat, Proceedings, Rome 1977

Table 2

Per capita meat consumption

	Actual consumption 1972 – 74 (kg/year)			
	Beef and veal	Mutton and lamb	Pork	Total
World	10.5	1.8	10.2	22.5
Developed nations	28.3	3.1	23.7	55.1
of which USA	51.8	1.2	29.6	82.6
EEC	24.0	3.1	28.7	55.8
Oceania	43.0	35.3	13.9	92.2
Centrally planned countries	7.8	1.5	14.5	23.8
of which USSR	23.7	3.9	17.7	45.3
Developing countries	5.2	1.5	1.8	8.5
of which Africa	4.8	2.1	0.7	7.6
Latin America	19.0	1.2	6.3	26.5
Near East	5.0	6.4	0.1	11.5
Far East	1.2	0.6	1.1	2.9

Source: FAO, Intergovernmental Group on Meat, Proceedings, Rome 1977

countries of the European Economic Community for example, have recently announced sanitary measures aimed at suspending the import of meat from countries unable to meet imposed veterinary regulations and Canada for several years has restricted her source of imports to countries which meet demanding health and sanitary regulations. Further, some countries which have no specific requirements themselves may adopt regulations from other meat importing nations or follow recommendations set out by an International Agency.

The trends outlined above, in conjunction with the implementation of livestock development programmes in a number of developing countries during recent years, have shown the need for investment in appropriate slaughter facilities to cope with the existing and projected expansion in livestock offtake numbers. Slaughter is an integral part of any livestock programme and if full benefits are to be gained from the introduction of improved animal breeding and husbandry techniques due consideration must be given to the consequent increased demand on existing slaughterhouse facilities.

However, the scarcity of information related to the cost of building and equipping small- and medium-scale units presents an obstacle to administrators planning either to replace obsolete slaughter facilities or to expand facilities for slaughter. The slaughterhouses catering for low daily throughputs are often overlooked and the needs of the surrounding rural communities ignored. Even where the requirements of rural communities have been considered, lack of specific information has frustrated the prompt evaluation of proposals and plans have been delayed or cancelled.

AIMS AND OBJECTIVES OF THE REPORT

This report aims to provide some of the missing information indicated and is intended as a guide to the investment and operational requirements for the establishment of slaughter facilities in the tropics. It is not a blueprint for abattoir design and construction and provides only part of the information necessary in the planning of slaughter facilities.

It is directed at entrepreneurs and administrators in the public sector in developing countries who are involved with the allocation of funds for rural and urban projects. It is also designed to be of assistance to technical advisors who may be concerned in the planning and implementation of livestock and meat marketing programmes.

The approach adopted in this report is to outline the development of a series of physical cost models giving the inputs of equipment, building space, labour, services and materials required for a range of small to medium-sized abattoirs. To illustrate the workings of these models specific factor costs relevant to developing countries in 1977 have been applied, and the economic performance of the models examined. This methodology can be used with local cost/price data for any specific locality to provide a preliminary estimate of capital and annual operating costs and to evaluate potential profitability and calculate slaughter charges.

It has been assumed that in using this report all available information relating to local requirements, throughputs, systems of operation etc., would be carefully considered.

SCALE OF OPERATION

Investment in slaughter facilities should not be considered without reference to the wider livestock/meat industries, as it is but one part of these. Guidance will then be obtained as to the types and numbers of livestock to be handled and hence to the appropriate size of abattoir to be constructed. Further knowledge of existing conditions of slaughter, existing and proposed health regulations (including those governing potential export markets) and legal requirements would be essential.

The size of abattoir should be chosen after consideration of a number of factors. Chief amongst these will be the numbers of livestock within range of the abattoir (this will be partly determined by conditions and cost of transport of beasts to slaughter); the market for meat products within the area to be served by the abattoir; existing slaughter facilities; regulations controlling the movement and slaughter of livestock; the availability of services, staff etc.

Throughout the world, for all types of livestock there is a marked variation in the average dressed carcase weight of animals slaughtered. This reflects differences in climatic adaptability, animal husbandry practices, transportation of beasts to slaughter, genetic potential and the average age of beasts at slaughter (see Table 3). It should be noted therefore that average dressed carcase weights of 200 kg for cattle, 20 kg for small stock and 70 kg for pigs, have been assumed in this report for the purpose of evaluating plant requirements.

Table 3

Carcase meat yields, worldwide

Region	Carcase meat yields 1976 (kg/animal)		
	Beef and veal	Mutton and lamb	Pork
World	195	15	68
Developed nations	227	16	73
of which N America	247	24	74
W. Europe	219	15	73
Oceania	171	16	52
Centrally planned nations	173	15	66
of which Russia	176	15	80
Developing nations	162	14	54
of which Africa	124	12	44
Latin America	192	15	63
Near East	113	16	64
Far East	117	9	46

Source: FAO, Production Yearbook Vol 30, Rome, 1977

Chapter 2

Development of the Cost Models

INTRODUCTION

Four cost models have been developed to illustrate the capital and operational costs of small and medium-scale abattoirs, differing with respect to : (i) the number and mix of livestock types handled each day; (ii) the extent of by-products recovery and the provision of cold store facilities.

The smallest abattoir built to acceptable standards is likely to be able to slaughter about 15 livestock units a day. Model 1 represents such a facility, taking account of simple design and technology which may be more appropriate to the needs of larger rural communities. In Models 2 to 4 the requirements for modern, improved slaughter facilities emphasising the need to maintain the highest levels of hygiene are developed. These three larger models would be capable of satisfying demands arising from concentrations of population in urban areas of various sizes and might also contribute to meeting demand arising on a regional and/or national level. Abattoirs capable of handling throughputs exceeding the 275 livestock units a day of Model 4 would require fully mechanised plants possibly incorporating deboning, meat processing and distribution facilities which are outside the scope of this report.

The levels of population which might be served by abattoirs of different design capacity could be estimated by calculating the total weight of meat produced from the average dressed carcase weights (see Chapter 1, 'Scale of Operation') and daily (annual) throughput of slaughter stock and relating it to *per capita* consumption of meat in the locality (see Table 2 for some regional average figures). For instance, over 250 days operation, Model 1 could produce 250,000 kg of beef carcases, 75,000 kg of small stock carcases, and 262,500 kg of pig carcases representing 187,500 kg beef, 56,300 kg mutton and 196,900 kg of pork assuming a carcase bone content of 25%.

It should be emphasised at this point that although the scope for the establishment of the export of meat has been mentioned (Chapter I, 'Introduction') none of the models in this report have been developed with an export capability specifically in mind. Further detailed consideration would need to be given to this aspect which has not been covered in this report.

It is assumed in the development of these designs that the cost model abattoirs engage solely in animal slaughter and carcase dressing and are not involved in the purchase of livestock or sale of the subsequent carcase meat. A service is provided to farmers and/or butchers for which a handling and slaughter fee is charged. This is the simplest form of operation which can be undertaken by slaughterhouse management.

The cost models are based upon a single 8 hour shift operation over 250 working days a year, but can be adapted to show the effects of introducing a further shift or extending the number of working days per year.

LIVESTOCK UNIT

The throughput which each model has been designed to handle is expressed in terms of livestock units. The livestock unit is a measure by which different types of animals can be compared on an equivalent basis. To convert slaughter animals to livestock units the following factors have been applied:

Cattle/buffalo equivalent to 1.0 livestock unit;
Smallstock (Sheep/goats) equivalent to 0.2 livestock units;
Pigs equivalent to 0.5 livestock units.

BY-PRODUCT TREATMENT

In designing the models, allowance has been made for a varying degree of sophistication of by-product treatment. Edible offals, cattle hides and sheepskins and bone/blood meal would be available. It is assumed that edible offals remain the property of the owner of the beast slaughtered. It is further assumed that cattle hides and sheepskins and blood/bone meal are sold by the abattoir and the proceeds set against the cost of slaughter. The cattle hides and sheepskins would be air dried. Blood/bone meal would be subject to processing, details of which are given in Appendix II.

COLD STORE FACILITIES

For those models (Models 2, 3 and 4) in which a carcase chilling facility has been assumed, three cold rooms are included:

Room A to cool beef through 23°C (38°C to 15°C) in 20 hours and mutton through 31°C (38°C to 7°C) in 12 hours.
Room B to cool beef through 14°C (15°C to 1°C) in 24 hours.
Room C to cool pork through 28°C (38°C to 10°C) in 15 hours.

The three models would each have all three of the cold rooms although the capacity in each case would be related to design daily throughput (see this chapter, 'The Cost Models'). In addition Models 3 and 4 should have a small condemned/detained carcase room (see 'Chilling facilities', Appendix II).

Beef would be cooled initially in Room A and then be transferred to Room B for chilling to a lower temperature.

All rooms would be of the walk-in type with full insulation, air curtains, remote temperature charts etc. Where cold storage is not provided, carcase meat would be dispatched at ambient temperatures. Edible offals would be similarly treated. Investment in a stand-by electricity generator has been accounted for in those models with cold storage facilities.

COSTS

The cost of capital equipment has been taken at 1977 fob UK prices for imported items, and estimates made for items of local manufacture and construction. Additionally, an allowance of 15% has been made in the case of imported equipment to cover insurance/freight. Where appropriate an allowance of 15% has been made to cover installation and erection costs (25% in the case of refrigeration equipment).

A list of capital equipment items is given for each model in Appendix III.

Annual operating costs have been set at levels likely to be found in developing countries.

A uniform cost of land has been used in the models for illustrative purposes only. In practice the cost of land would be lower in a rural environment than in an urban environment and the cost in an urban situation could be considerably higher than that used here. In many situations land will be available for lease by payment of an annual rent.

THE COST MODELS

The technical characteristics of the cost models are summarised in Table 4. A fuller explanation of methods of slaughter and dressing are given in Appendix II. In the remainder of this section the composition of throughput, capacity of by-product recovery and chilling facilities, and capital and annual operating costs are set out for each model. The capital and annual operating costs of the models which are used in the analysis carried out in the next chapter are summarised in Table 5. These costs have been derived from the physical requirements and financial values detailed in Appendix I, Tables 1 to 4.

Model 1

An abattoir designed to handle, in an 8 hour working day, 15 livestock units consisting of 5 cattle, 15 small stock and 15 pigs. The abattoir would be equipped for the air drying of cattle hides and sheepskins. 1,250 cattle hides and 3,750 sheepskins would be produced a year. Blood/bone meal would not be produced, the raw material going to waste or being taken by outside contractors.

There would be no cold storage facility.

Total investment, including working capital, would be £29,880. Annual operating costs would be £5,940 or £1.58 per livestock unit. (See Table 5, rows 8 and 18, Model 1).

Model 2

An abattoir designed to handle, in an 8 hour day, 60 livestock units consisting of 25 cattle, 50 small stock and 50 pigs. The abattoir would be equipped for the air drying of cattle hides and sheepskins. 6,250 cattle hides and 12,500 sheepskins would be produced per year. Blood/bone meal would not be produced, the raw material going to waste or being taken by outside contractors.

The cold store facility would be able to cool and hold over a 24 hour period 5,000 kg of beef, 1,000 kg of mutton and 3,600 kg of pork. (In Chapter 3 the effect of not including a cold storage facility has also been investigated).

Total investment, including working capital, would be £158,880. Annual operating costs would be £24,870 or £1.66 per livestock unit. (See Table 5, rows 8 and 18, Model 2).

Model 3

An abattoir designed to handle, in an 8 hour day, 155 livestock units consisting of 50 cattle, 150 small stock and 150 pigs. The abattoir would be equipped for the air drying of cattle hides and sheepskins. 12,500 cattle hides and 37,500 sheepskins would be processed per year. Blood/bone meal would be produced at the rate of 187.5 tonnes a year.

The cold store facility would be able to cool and hold over a 24 hour period 10,000 kg of beef, 3,000 kg of mutton and 11,000 kg of pork.

Total investment, including working capital, would be £435,090. Annual operating costs would be £60,370 or £1.56 per livestock unit. (See Table 5, rows 8 and 18, Model 3).

Table 4

Summary of methods of slaughter and dressing in the Cost Models

Item	Model 1	Model 2	Model 3	Model 4
1 Throughput in livestock units a day	15	60	155	275
2 Lairage	Hard standing with tie rail for cattle, pens for small stock and pigs. Water troughs	Reception area, pens with interlinking passages to stunning areas for each livestock class. Water troughs for each pen. Isolation pens for Models 3 and 4		
3 Stunning	Drag chain and tie hook for cattle. Captive bolts — all species	Stunning pen for cattle. Captive bolts for cattle and small stock, electrolethaler for pigs		
4 Bleeding		Horizontal sticking and vertical bleed for all species	Vertical sticking and bleeding — all species	
5 Dressing				
(i) Cattle — clearing		Horizontal, mobile cradle		Vertical, rail
flaying		Vertical, hoist and gambrel	Vertical, rail	
evisceration	Vertical, gambrel		Vertical, rail	
(ii) Small stock — clearing		Horizontal, mobile cradle		Vertical, rail
flaying		Vertical, hook and gambrel	Vertical, rail	
evisceration		Vertical, hook and gambrel	Vertical, rail	
(iii) Pigs — scald	Tank	Tank	Tank	Tank
scrape	Table	Table	Dehairing machine	
evisceration	Vertical, hoist and gambrel		Vertical, rail	
6 Chilling	Holding rooms, dispatch at ambient	Chilling facilities for all carcases (see Chapter 2, 'Cold store facilities') Dispatch chilled		
7 Disposal of condemned material	Bury in lime	Incinerator		
8 Monitor of live and hot carcase weights	Liveweight scales — optional not costed		Liveweight scales	
	No carcase scales		On-line carcase scales	
9 By-product treatment			Air drying of cattle hides and sheepskins	
	No treatment other than wash where necessary.		Either render in conventional plant or wash where necessary. Rendering equipment costed	
10 Effluent and water		Septic tank	Either aerobic treatment plant or septic tank system. The former costed.	
	Chlorination tablets added to water tank	Chlorination plant	Chlorination plant and steam generator	

Model 4

An abattoir designed to handle in an 8 hour day, 275 livestock units consisting of 100 cattle, 250 small stock and 250 pigs. The abattoir would be equipped for the air drying of cattle hides and sheepskins. 25,000 cattle hides and 62,500 sheepskins would be available per year. Blood/bone meal would be produced at the rate of 375 tonnes per year.

Table 5

Cost Models – Summary of capital and annual operating costs

£ Sterling

Item	Model 1	Model 2	Model 3	Model 4	Notes
Capital costs					
1 Plant & equipment	5,980	60,930	186,030	285,020	See Appendix III
2 Installation	360	7,850	23,090	34,050	See Chapter 2 and Appendix III
3 Building costs	18,970	69,500	171,700	292,500	See Appendix I, Table 1
4 Land	500	500	1,000	1,500	See Appendix I, Table 1
5 Contingencies	2,580	13,880	38,180	61,310	10% of rows 1 – 4
6 **Total fixed capital**	**28,390**	**152,660**	**420,000**	**674,380**	Sum of rows 1 – 5
7 Working capital	1,490	6,220	15,090	25,140	3 months operating costs
8 **Total investment**	**29,880**	**158,880**	**435,090**	**699,520**	Sum of rows 6 & 7
Operating costs					
9 Personnel	3,230	7,740	14,310	21,920	See Appendix I, Table 2
10 Maintenance & spares	1,250	6,880	19,040	30,600	5% of rows 1 – 3
11 Water and sewage	180	660	1,830	3,140	See Appendix I, Table 2
12 Electricity	390	6,510	11,800	23,210	See Appendix I, Tables 3 and 4
13 Fuel oil	–	–	6,770	10,310	See Appendix I, Table 4
14 Other items of operating equipment	440	1,100	1,700	3,220	See Appendix III
15 Sacks	–	–	310	620	See Appendix I, Table 4
16 Insurance	250	1,380	3,810	6,120	1% of rows 1 – 3
17 Sundries	200	600	800	1,400	Stationery, detergents, solvents etc
18 **Total operating costs**	**5,940**	**24,870**	**60,370**	**100,540**	Sum of rows 9 – 17

The cold store facility would be able to cool and hold over a 24 hour period 20,000 kg of beef, 5,000 kg of mutton and 18,000 kg of pork.

Total investment, including working capital, would be £699,520. Annual operating costs would be £100,540 or £1.46 per livestock unit. (See Table 5 rows 8 and 18, Model 4).

Chapter 3

Financial analysis of the abattoirs

INTRODUCTION

In this chapter a simple method of financial analysis will be applied to the cost models. The intention is to show how this report can be used to carry out costings in any particular location. By applying the data on physical cost requirements given in Appendix I, Tables 1–4, in conjunction with local factor costs, some indication of the basic economics of an installation in different local situations can be obtained.

It should be emphasised that although a simple method of financial analysis is demonstrated to show how the models might be used in or adapted to the conditions in different parts of the world, the report is not intended to provide a financial analysis of a particular enterprise operating such installations. Such a financial analysis would require, apart from local factor costs, detailed knowledge of the capital structure of an enterprise (both equity and loan contributions), as well as knowledge of the taxation and depreciation provisions of the country in which it operated.

The previous chapter concentrated on the design and cost of small and medium scale abattoirs as represented by the four cost models. Although the physical throughput of each model was given there was no discussion of the revenue which would accrue through the operation of these facilities. However, for purposes of financial analysis, it is necessary to examine the cost models in order to derive 'break-even' slaughter fees. These are the fees which would have to be charged if sufficient revenue is to be earned each year to cover all costs and to give a return on capital employed equal to the opportunity cost of that capital. Consideration has not been given to fees which might be charged in addition to the slaughter fee, eg inspection fee, special dressing fee or early attendance fee.

It will be noted that for the purpose of the report, the slaughter fee calculation has assumed that the abattoir will receive revenue from the sale of certain categories of by-products. If by-products remain the property of the butcher, a corresponding correction to the slaughter fee might have to be made.

In the case of a condemned animal, provision should be made to deduct the slaughter fee from the compensation paid.

DISCOUNTED CASH FLOW ANALYSIS

The discounted cash flow method will be used to assess the break-even slaughter fees. This method enables a comparison of costs and receipts over a period of time to be made and summarised as the net present value (NPV). This figure is the sum of the difference between inward (+) and outward (–) annual cash flows discounted at a

particular rate over a period of time. Alternatively the internal rate of return can be calculated. This is the discount rate which will equate inward and outward annual cash flows over a period of time, or, in other words, that will give a net present value of zero. These measures are designed to assess the relative financial viability of the different abattoirs to the organisation(s) which might consider establishing them. In particular it provides an estimate of the return to capital investment after recovery of that investment. Hence it enables alternative schemes to be compared and placed in an order of rank from the point of view of financial performance.

The cost models are analysed over a life of 20 years. A residual (or terminal) value is allowed for those items of fixed capital cost with a life extending beyond year 20. For each model it is derived from Appendix I, Table 1 (land and building space requirements) and from Appendix III (column (c)) which gives the estimated life of the items of equipment. The residual value is calculated on a proportional basis according to the number of years useful life remaining after year 20. Thus for buildings a life of 30 years has been assumed and at year 20 the residual value would be one-third (10/30) of the original value. In the discounted cash flow analysis of Appendix I, Tables 5–8 the residual value is treated as a cash inflow and is entered in year 20 as a negative figure to be deducted from the cash outflow for that year.

A discount rate of 10% has been applied to derive the break-even slaughter fees. This corresponds to the test discount rate adopted by the UK Ministry of Overseas Development in project appraisal. It is illustrative and is not intended as a comment on what is appropriate in all circumstances. The selection of the appropriate rate of return should be made through an assessment of local circumstances.

The aim of the analysis is to estimate the livestock unit slaughter fee which will generate sufficient cash inflow over 20 years to give an internal rate of return of 10% for each of the cost models. When the fee for each of the basic cost models has been established, the analysis can be extended to consider the variations made to those models, in particular to analyse sensitivity to cost assumptions, throughput etc.

The scope of this report is limited to a simple financial analysis. If it had been extended to cover an analysis of the economic rate of return, the discounted cash flow method of calculation need not have been confined to a consideration of the cash outflow (or costs). By using an assumed added value, attributable to the meat from beasts slaughtered, which could not have been realised without proper facilities, as the basis of an imputed annual revenue a cash inflow stream could have been built up. A full discounted cash flow analysis could then have been undertaken to calculate the economic rate of return.

The economic rate of return assesses the effects of the project on the economy as a whole, reflecting the opportunity cost to the economy of those inputs used in and outputs derived from the project. The calculation of the economic rate of return differs from that of the financial internal rate of return, which assesses the financial worthwhileness of the project to the organisation that undertakes it, chiefly by adjustment of the values of inputs and outputs to their opportunity cost rather than their market valuation and by adjustment to eliminate the effect of transfer payments within the economy such as taxes and subsidies.

THE METHODOLOGY

Table 6 summarises the results of the steps taken in estimating the livestock unit slaughter fees. These steps are explained in the notes to Table 6.

Table 6

Estimation of the livestock unit slaughter fees

	Model 1	Model 2	Model 3	Model 4	Notes on derivation
1 Discounted cash outflow (20 years at 10% discount rate)	£81,468	£369,269	£960,857	£1,594,086	Appendix 1 Tables 5–8
2 Total annual receipts for by-product recovery	£1,813	£8,125	£32,188	£62,500	Table 7 (Rows 2+5+8)
3 Present value of annual receipts (row 2) over 20 years at 10% discount rate	£15,436	£69,176	£274,049	£532,125	Row 2 x 8.514
4 Discounted cash outflow adjusted to take account of receipts from by-product recovery	£66,032	£300,093	£686,808	£1,061,961	Row 1 minus row 3
5 Livestock unit slaughter fees	£2.07	£2.35	£2.08	£1.81	Row 4 ÷ 8.514, then result ÷ number of livestock units handled a year

Note: Row 1: Calculcation of discounted cash outflow for each model is the first step. Appendix I, Tables 5–8 demonstrate how the discounted cash outflow is built up for each model. The results are presented in this row.

Row 2: The second step is to adjust the discounted cash outflow at row 1 to allow for the revenue earned each year from by-product recovery. The by-products to be recoved and sold were given in Chapter 2, By-product treatment', as cattle hides, sheep skins and blood/bone meal, the quantity varying between models. The annual receipts from the sale of these by-products are shown in Table 7. For illustrative purposes of analysis the sale price of cattle hides and sheep skins is taken as £1.00 and £0.15 per animal respectively. These assumptions are then relaxed to investigate the effect of a higher price for these and a 50% increase in the sale price is used. The sale price of blood/bone meal is taken as £75/tonne. Total receipts each year from by-product recovery assuming constant throughput are shown in this row, confining attention for the moment to the effect of the lower price level for hides and skins.

Row 3: The receipts in row 2 are to be treated as constant annual revenues over 20 years, to be discounted at 10%. Using factors representing the present worth of an annuity* it is easy to obtain the present value of a constant flow of money over a number of years at any particular discount rate. In the case considered here (20 years and 10% discount rate) the annual amounts would be multiplied by a factor of 8.514 to give the present value of those amounts received over 20 years. The discounted net value of receipts from by-product recovery are shown in this row.

Row 4: Deducting row 3 from row 1 gives the discounted cash outflow adjusted to take account of receipts from by-product recovery. These net present values are shown in this row.

Row 5: The livestock unit slaughter fee which will generate an annual revenue stream, discounted over 20 years at 10%, equal to the adjusted discounted cash outflow at row 4 can now be estimated. This is the fee which allows the project to 'break-even' at a 10% discount rate. To obtain this break-even slaughter fee the adjusted discounted cash outflow at row 4 is divided by the factor 8.514, giving the annual receipts from the slaughter fee required. These sums are then divided by the number of livestock units slaughtered/year for each model. The livestock unit slaughter fees derived in this manner are shown in this row.

*For examples see tables in Appendix V.

Table 7

Annual receipts from the sale of by-products

	Model 1	Model 2	Model 3	Model 4
Cattle hides				
1 Quantity	1,250	6,250	12,500	25,000
2 Total revenue (£1 a hide)	£1,250	£6,250	£12,500	£25,000
3 Total revenue (£1.50 a hide)	£1,875	£9,375	£18,750	£37,500
Sheep skins				
4 Quantity	3,750	12,500	37,500	62,500
5 Total revenue (£0.15 a skin)	£563	£1,875	£5,625	£9,375
6 Total revenue (£0.225 a skin)	£884	£2,813	£8,438	£14,063
Blood/bone meal				
7 Quantity (tonnes)	–	–	187.5	375
8 Total revenue (£75 a tonne)	–	–	£14,063	£28,125

The analysis can be extended to measure the sensitivity of the basic cost models to changes in the value of certain variables, the extent of the facility provided and the throughput handled. The livestock unit slaughter fees which would result from the introduction of these changes are set out in Table 8. These should be compared with row 8 of that table which repeats row 5 of Table 6. The relative performance of the cost models and the changes in assumptions are discussed in the next section.

Table 8

Livestock unit slaughter fees with changed assumptions

	Model 1	Model 2	Model 3	Model 4
1 Lower building cost(1) (Model 1 only); £50/m^2 instead of £70/m^2	£1.80	–	–	–
2 No cold store facility (Model 2 only)	–	£1.52	–	–
3 No by-product recovery other than edible offals	£2.39	£2.80	£2.67	£2.54
4 Higher price for cattle hides and sheep skins (see Table 7, rows 3 and 6)	£1.83	£2.08	£1.85	£1.56
5 Lower throughput than basic models (60% – 3 day week)	£3.21	£3.86	£3.53	£3.17
6 Lower throughput than basic models (80% – 4 day week)	£2.49	£2.92	£2.61	£2.31
7 Higher throughput than basic models (120% – 6 day week)	£1.80	£2.07	£1.75	£1.51
8 Basic cost models	£2.07	£2.35	£2.08	£1.81

Note: (1) Relates to row 1 of this table only. In rows 3 to 8 the higher building cost (£70/m^2) as originally used in the basic cost Model 1 is applied.

RELATIVE PERFORMANCE OF THE COST MODELS

The relative performance of the basic cost models can be assessed from row 8 of Table 8. Model 1 appears to give a more favourable result than Models 2 and 3 and a less favourable result than Model 4. However, in making a comparison between Model 1 and the other three models it is important to remember that the purpose for which it is intended differs from that of those three. As emphasised in Chapter 2, 'The Cost Models' and Appendix II, it represents a simpler technology using a less sophisticated (and cheaper) building structure and is without a chilling facility. It is more appropriate to the needs of rural communities whereas the other three models represent slaughter facilities able to serve urban communities with a higher degree of mechanisation.

Row 2 of Table 8 shows the effect of putting Model 2, which had the highest livestock unit slaughter fee of any of the basic cost models, onto a more comparable basis with Model 1. This is achieved by the omission of the chilling facility included in the basic cost Model 2. This change reduces the livestock unit slaughter fee required to such an extent that it would be lower than that for the basic cost Model 1. Thus it can be seen that the decision whether or not to include a chilling facility has a significant effect on the scale of fees charged.

A comparison for each model of the annual operating costs per livestock unit given in Chapter 2, 'The Cost Models' with the livestock unit slaughter fees in row 8 of Table 8 brings out the difference in cost structure between Model 1 and the three other models. When comparing only annual operating costs the relative position of Model 1 ceases to be so favourable. Annual operating costs are a more significant element in the total costs of Model 1 than in the case of the other three models and, in addition to Model 4, Model 3 will now have a lower unit cost than Model 1. This is also illustrated in Table 9 which shows annual operating costs in relation to fixed capital costs and personnel costs as a proportion of total annual operating costs.

Table 9

Relative cost structure of the models (%)

	Model 1	Model 2	Model 3	Model 4
Annual operating costs Fixed capital cost	20.9	16.1	14.2	14.9
Personnel costs Annual operating costs	54.4	31.1	23.8	21.9

Source: Rows 6, 9 and 18 of Table 5

Turning attention to the largest three models, a comparison of Models 2, 3 and 4 shows economies of scale to be present. A slight bias is introduced against Model 2 compared to the other two models by the assumption that no revenue from blood/bone meal would be available to be offset against costs.

The livestock unit slaughter fee shown in row 3 of Table 8 (no by-product recovery) has been calculated to illustrate the potential economic advantages to be gained from by-product recovery, or the 'fifth quarter' as these are sometimes called. It is assumed that edible offals would still be available to the farmer/butcher. The increase in the livestock unit slaughter fee required to compensate for the loss of the revenue from by-product recovery assumed in the basic cost models would range from 15% (Model 1) to 40% (Model 4). This is further illustrated in row 4 of Table 8, where the higher price for hides and skins (rows 3 and 6 of Table 7) has been applied in the calculation of the livestock unit slaughter fee. A considerable reduction in the fee compared to the basic cost models could then be effected, ranging from 11% (Models 2 and 3) to 15% (Model 4).

The effect of varying the annual throughput of livestock is shown in rows 5, 6 and 7 of Table 8. Decreases of 40% and 20% and an increase of 20% in annual throughput compared to the basic cost models have been examined. These would correspond to working over 3, 4 and 6 days a week (150, 200 and 300 days a year) respectively compared to the 5 days a week (250 days a year) assumed in the basic cost models. To allow for this, appropriate adjustments in variable costs have been made. The same proportional throughputs over a 5 day week would raise the fee by 5% to 10% compared to the fees in Table 8 (60% and 80% throughput only).

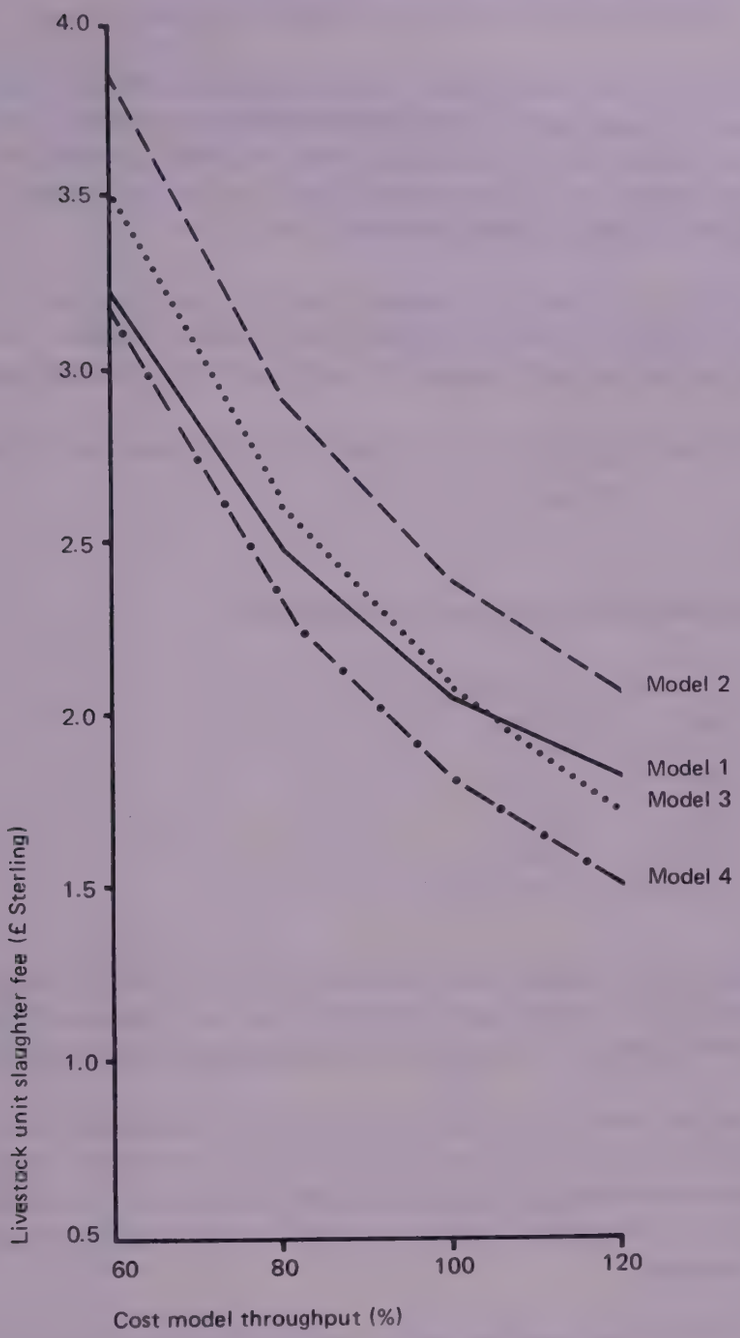
These variations in throughput again illustrate the effect of the difference in cost structure between Model 1 and the other three models. Compared with the basic cost model situation, its performance relative to those models improves as throughput falls below that assumed in the basic cost models. Conversely it worsens as throughput rises above that assumed in the basic cost models, to the extent that Model 3 would have a lower break-even slaughter fee than Model 1 in the higher throughput case whereas it had a higher fee than Model 1 in the basic cost model situation.

The relationship between the break-even livestock unit slaughter fee and variations in the cost model throughputs are illustrated graphically in Figure 1.

Annual throughput might be increased by the introduction of a second shift in the case of the larger models. Assessing the effect of this is not quite as simple as in the case of working an extra day a week. Allowance has to be made for the capacity limitations of certain parts of the abattoir. If further shift operation is planned particular attention will have to be given to cold storage facilities, to hide drying and storage, to sewage treatment and lairage capacity.

The relative importance of each livestock type in the daily throughput also varies between cost models. The detailed descriptions of each model in Chapter 2, 'The cost models' indicate this. It can also be illustrated by the volume of work attributable to each livestock type. This is shown in Table 10.

Figure 1
Livestock unit slaughter fee in relation to variations in model throughputs



Note: 100% throughput represents the basic cost models (5 day week)
120% throughput represents 6 days a week working
80% throughput represents 4 days a week working
60% throughput represents 3 days a week working

Table 10

Proportion of work-load in livestock unit equivalents attributable to handling different livestock types (%)

	Cattle	Small stock	Pigs
Model 1	33.0	20.0	47.0
Model 2	41.5	17.0	41.5
Model 3	32.5	19.5	48.0
Model 4	36.5	19.0	45.5

This will have some effect on the relative economics of the cost models as no revenue is assumed to be available from pig skins to be offset against costs, compared to its assumed availability from cattle hides and the skins of small stock.

SLAUGHTER FEE

The discounted cash flow analysis of the models has provided an estimate of the slaughter fee for each livestock unit. A further simple step needs to be taken in order to derive an appropriate fee for each type of animal slaughtered.

Conversion factors to bring different types of animal to a livestock unit equivalent were given in Chapter 2, 'Livestock unit'. The same relationship as that for the animals would hold for the slaughter fee. By applying these factors to the estimated livestock unit slaughter fees in Table 8 the approximate fees to be charged for each type of animal actually slaughtered can be established.

From the factors given in Chapter 2, 'Livestock unit' it is evident that the appropriate fee for the slaughter of cattle would be equal to that for the livestock unit. For small stock and pigs the fee would be one-fifth and half that of cattle respectively.

The slaughter fee for each livestock type derived from the basic cost models is given in Table 11.

Table 11

Slaughter fee for each livestock type, basic cost models

£ Sterling

	Cattle	Small stock	Pigs
Model 1	2.07	0.41	1.03
Model 2	2.35	0.47	1.18
Model 3	2.08	0.42	1.04
Model 4	1.81	0.36	0.91

A number of variations to the basic costs models were considered in the discussion of the discounted cash flow analysis (see Table 8). The same step as above would be followed in these cases to derive the slaughter fee appropriate to each type of animal.

The fees estimated by the method outlined in Chapter 3, 'The methodology' and the paragraphs above should be compared with charges prevailing under local market conditions. The actual fees charged should be based not only on a consideration of costs as emphasised in this report but also on a detailed knowledge of the local livestock and meat markets.

As an alternative to the method applied so far, the models could be tested by applying the slaughter fee considered appropriate to local circumstances. The internal rate of return to the models resulting from such a fee (and the consequent annual revenue stream) could be estimated or the Net Present Value with the discount rate set at different values (including 10% as used here) could be determined. Appendix I, Table 9 demonstrates how this analysis would be built up, using Model 1 with a livestock unit slaughter fee of £2.00 as an example.

In some circumstances it may be found that the fee considered appropriate to local market conditions would result in the abattoir running at a loss or at a lower rate of return than desired. Expressed in another way, the fee estimated by the method set out in this report that would recover the costs of improved abattoir facilities and provide an adequate rate of return on capital employed (here taken as 10%) would be higher than that charged under existing conditions of slaughter. Under such conditions it would be advisable to attempt to set a fee which at least covered operating costs (see Chapter 2, 'The cost models' and row 18 of Table 5).

To encourage the use of the improved facilities the control of slaughter by legislation and/or the subsidising of the operation of those facilities then might have to be considered. The cost models would assist in determining a preliminary estimate of the amount of financial aid likely to be needed.

The setting of the slaughter fee would be affected not only by the cost and market conditions but also by the policy and objectives of the organisation running the abattoir. At the levels of production examined in this report an abattoir could be run by one of the following:

1 private commercial enterprise;
2 producer co-operative;
3 local government authority;
4 parastatal body responsible for regional/national development of livestock and/or meat marketing.

The objectives of such bodies may well differ and hence so may the policy followed in setting the slaughter fee.

Appendix I

Tables

Table 1

Cost Models — Land and building space requirements

	Item		Model 1	Model 2	Model 3	Model 4
A	Land area (hectares)(1)		0.2	0.2	0.4	0.6
B	Building area (square metres)(2,3)					
1	Slaughter hall	— Cattle and smallstock	25	56	93	149
		Pigs	15	42	42	56
2	Tripery	— Cattle and smallstock	8	19	28	56
		Pigs	8	9	28	56
3	Red offal room	— Cattle and smallstock			14	14
		Pigs			14	14
4	Hanging room	— Cattle and smallstock	10	45	84	138
		Cattle	—	34	63	102
		Pigs	6	28	57	88
5	Lairage	— Cattle and smallstock	65	102	279	513
		Pigs	10	60	140	223
6	Emergency slaughter	— Cattle and smallstock	—	17	21	21
		Pigs	—		17	17
7	Hides and skins	— Drying area	56	140	395	756
		Storage	6	37	56	112
8	Plant room — Boiler and refrigeration		—	19	37	56
9	By-products room		—	—	47	74
10	Drained yard (Vehicle hygiene, bedding and dumping ramp)		20	47	91	121
11	Stores and workshop		—	—	66	133
12	Laundry		—	—	28	47
13	Offices		6	6	46	65
14	Changing room, toilet		18 + 18	18	24	32
15	Mess room		—	16	22	37
16	First aid room		—	—	6	19
17	Composting site		—	—	19	26
18	Total		271	695	1,717	2,925

Notes: (1) Cost of land taken at £2,500/hectare.
(2) Cost of building taken at an average of £100/m^2 for Models 2, 3 and 4 and at £70/m^2 for Model 1 Model 1 also costed at average of £50/m^2 in Chapter 3.
(3) Building assumed to have a life of 30 years.

Table 2

Cost Models — Manpower requirements

Item	Unit cost per year (£) Sterling	Model 1	Model 2	Model 3	Model 4
1 Manager	1,500	—	—	1	1
2 Manager/supervisor	1,200	—	1	—	—
3 Manager/clerk	1,000	1	—	—	—
4 Supervisor	750	—	—	1	2
5 Clerk	500	—	1	1	2
6 Slaughtermen	500	4	7	12	18
7 Labourers	350	—	3	5	8

Notes: The manpower requirements reflect average conditions. The unit costs include no allowance for pensions and welfare contributions related to salaries. Accordingly in row 9 of Table 5 (text) an allowance of 10% of salaries for positions 1 — 5 above, has been included. In addition to the above, the services of specialist labour (plumber, electrician, refrigeration engineer) would be needed occasionally. To allow for these, an estimate has been added to row 9 in Table 5 (text), taken as 1% of building and equipment costs, (0.5% in Model 1).

Table 3

Cost Models — Electricity requirements

Item	Unit rating	Percentage use in 8 hours	Number of items per model: Model 1	Model 2	Model 3	Model 4
Hoists	5hp	25	—	2	5	5
Evisceration tables	4hp	75	—	—	—	1
Saw platforms	3hp	10	—	—	1	1
Saws	3hp	5	—	—	1	2
Leg spreaders	2hp	5	—	—	—	1
Electrolethaler	0.5kW	0.75	—	1	1	1
Elevator	2hp	75	—	—	1	1
Pig dropper	2hp	75	—	—	—	1
Scald tank[4]	3hp	75	1	1	1	1
Dehairer	7.5hp	75	—	—	1	1
Whetstone	0.1kW	5	1	1	1	1
Tripe washers	2hp	75	—	—	4	6
Casing cleaners	1hp	75	—	—	5	7
Chlorination plant	1.25hp	125	1	1	1	1
Pressure melters	15hp	100	—	—	1	1
Centrifuge	5hp	10	—	—	1	1
Fat pump	1hp	10	—	—	1	1
Mill/screen bagger	35hp	(1)	—	—	1	1
Water pump	1hp	125	—	1	1	1
Steam generator	3hp	125	—	—	1	1
Aerobic treatment plant	5hp	300	—	—	1	1
Workshop	5hp	10	—	—	1	1
General lighting[2]						
Hot plates	1.5kW	10	—	1	2	4
Urn	1.5kW	10	—	—	1	1
Insectocuters	0.05kW	300	—	—	8	12
Fans	0.1kW	100	—	—	6	8
Mobile pressure washer	2hp	10	—	1	—	—
Cold store facility[3]			—	1	1	1

Notes: (1) 10% for Model 3, 20% for Model 4.
(2) Daily consumption of electricity in kWh: Model 1 40; Model 2 96; Model 3 255.2; Model 4 435.2.
(3) Cold store facility assumed to operate 5.5 days per week. Total Rating Model 2: 34 kW; Model 3: 46 kW and Model 4: 105 kW.
(4) Form of heating for scald tank subject to local conditions.

Table 4

Cost Models – Annual consumption of electricity, fuel oil, water and sacks

Item	Unit	Model 1	Model 2	Model 3	Model 4
1 Electricity	kWh	15,700	260,300	471,864	928,487
2 Fuel oil	Litres	–	–	41,000	62,500
3 Water	'000 Litres	2,770.30	9,945.25	27,703.00	47,593.75
4 Sacks	No	–	–	1,250	2,500

Notes: (1) Electricity cost calculated at £0.025 per kWh.
(2) Fuel oil cost at £0.165 per litre. Operating 10 hours per day. Model 3 uses 16.4 litres per hour, Model 4 uses 25 litres per hour.
(3) Water cost at £0.066 per '000 litres. Based on use at rates of: 273 litres/day/cattle; 455 litres/day/pig; 45 litres/day/smallstock; plus 25%.
(4) Cost of sacks at £0.25 each, assumed to be 50 kg capacity, paper (wax-lined). Used for blood/bone meal. Model 3 requiring 15 sacks per day, Model 4 requiring 30 sacks per day. Assumed to be re-usable; costed on basis of 33% being replaced each year.

Table 5

Discounted cash outflow, Model 1

£ Sterling

	Fixed capital	Working capital	Operating costs	Cash outflow	Discount factor (10%)	Discounted cash outflow
0	28,390	–	–	28,390	1.000	28,390
1	–	1,490	5,940	7,430	0.909	6,754
2	–	–	5,940	5,940	0.826	4,906
3	–	–	5,940	5,940	0.751	4,461
4	–	–	5,940	5,940	0.683	4,057
5	840	–	5,940	6,780	0.621	4,210
6	–	–	5,940	5,940	0.564	3,350
7	–	–	5,940	5,940	0.513	3,047
8	–	–	5,940	5,940	0.467	2,774
9	–	–	5,940	5,940	0.424	2,519
10	4,070	–	5,940	10,010	0.386	3,864
11	–	–	5,940	5,940	0.350	2,079
12	–	–	5,940	5,940	0.319	1,895
13	–	–	5,940	5,940	0.290	1,723
14	–	–	5,940	5,940	0.263	1,562
15	1,300	–	5,940	7,240	0.239	1,730
16	–	–	5,940	5,940	0.218	1,295
17	–	–	5,940	5,940	0.198	1,176
18	–	–	5,940	5,940	0.180	1,069
19	–	–	5,940	5,940	0.164	974
20	(6,580)	(1,490)	5,610	(2,460)	0.149	(367)
Total						81,468

Table 6

Discounted cash outflow, Model 2

£ Sterling

	Fixed capital	Working capital	Operating costs	Cash outflow	Discount factor (10%)	Discounted cash outflow
0	152,660	–	–	152,660	1.000	152,660
1	–	6,220	24,870	31,090	0.909	28,261
2	–	–	24,870	24,870	0.826	20,543
3	–	–	24,870	24,870	0.751	18,677
4	–	–	24,870	24,870	0.683	16,986
5	3,050	–	24,870	27,920	0.621	17,338
6	–	–	24,870	24,870	0.564	14,027
7	–	–	24,870	24,870	0.513	12,758
8	–	–	24,870	24,870	0.467	11,614
9	–	–	24,870	24,870	0.424	10,545
10	10,450	–	24,870	35,320	0.386	13,634
11	–	–	24,870	24,870	0.350	8,705
12	–	–	24,870	24,870	0.319	7,934
13	–	–	24,870	24,870	0.290	7,212
14	–	–	24,870	24,870	0.263	6,541
15	3,050	–	24,870	27,920	0.239	6,672
16	–	–	24,870	24,870	0.218	5,422
17	–	–	24,870	24,870	0.198	4,924
18	–	–	24,870	24,870	0.180	4,477
19	–	–	24,870	24,870	0.164	4,079
20	(43,570)	(6,220)	24,690	(25,100)	0.149	(3,740)
Total						369,269

Table 7

Discounted cash outflow, Model 3

£ Sterling

	Fixed capital	Working capital	Operating costs	Cash outflow	Discount factor (10%)	Discounted cash outflow
0	420,000	–	–	420,000	1.000	420,000
1	–	15,090	60,370	75,460	0.909	68,593
2	–	–	60,370	60,370	0.826	49,866
3	–	–	60,370	60,370	0.751	45,338
4	–	–	60,370	60,370	0.683	41,233
5	5,380	–	60,370	65,750	0.621	40,830
6	–	–	60,370	60,370	0.564	34,048
7	–	–	60,370	60,370	0.513	30,970
8	–	–	60,370	60,370	0.467	28,192
9	–	–	60,370	60,370	0.424	25,596
10	65,870	–	60,370	126,240	0.386	48,729
11	–	–	60,370	60,370	0.350	21,130
12	–	–	60,370	60,370	0.319	19,258
13	–	–	60,370	60,370	0.290	17,508
14	–	–	60,370	60,370	0.263	15,877
15	4,350	–	60,370	64,720	0.239	15,468
16	–	–	60,370	60,370	0.218	13,160
17	–	–	60,370	60,370	0.198	11,953
18	–	–	60,370	60,370	0.180	10,867
19	–	–	60,370	60,370	0.164	9,900
20	(95,760)	(15,090)	59,450	(51,400)	0.149	(7,659)
Total						960,857

Table 8

Discounted cash outflow, Model 4

£ Sterling

	Fixed capital	Working capital	Operating costs	Cash outflow	Discount factor (10%)	Discounted cash outflow
0	674,380	–	–	674,380	1.000	674,380
1	–	25,140	100,540	125,680	0.909	114,243
2	–	–	100,540	100,540	0.826	83,047
3	–	–	100,540	100,540	0.751	75,506
4	–	–	100,540	100,540	0.683	68,668
5	10,270	–	100,540	110,810	0.621	68,813
6	–	–	100,540	100,540	0.564	56,704
7	–	–	100,540	100,540	0.513	51,577
8	–	–	100,540	100,540	0.467	46,952
9	–	–	100,540	100,540	0.424	42,628
10	153,220	–	100,540	253,760	0.386	97,952
11	–	–	100,540	100,540	0.350	35,189
12	–	–	100,540	100,540	0.319	32,072
13	–	–	100,540	100,540	0.290	29,157
14	–	–	100,540	100,540	0.263	26,442
15	12,310	–	100,540	112,850	0.239	26,971
16	–	–	100,540	100,540	0.218	21,917
17	–	–	100,540	100,540	0.198	19,907
18	–	–	100,540	100,540	0.180	18,098
19	–	–	100,540	100,540	0.164	16,488
20	(158,400)	(25,140)	98,810	(84,730)	0.149	(12,625)
Total						1,594,086

Table 9

Discounted cash flow, Model 1 with a livestock unit slaughter fee of £2.00

£ Sterling

	Fixed capital	Working capital	Operating costs	Cash outflow	Cash[1] inflow	Net cash flow	Discount factor 10%)	Discounted cash flow
0	28,390	–	–	28,390	–	–28,390	1.000	–28,390
1	–	1,490	5,940	7,430	9,313	1,883	0.909	1,712
2	–	–	5,940	5,940	9,313	3,373	0.826	2,786
3	–	–	5,940	5,940	9,313	3,373	0.751	2,533
4	–	–	5,940	5,940	9,313	3,373	0.683	2,304
5	840	–	5,940	6,780	9,313	2,533	0.621	1,573
6	–	–	5,940	5,940	9,313	3,373	0.564	1,902
7	–	–	5,940	5,940	9,313	3,373	0.513	1,730
8	–	–	5,940	5,940	9,313	3,373	0.467	1,575
9	–	–	5,940	5,940	9,313	3,373	0.424	1,430
10	4,070	–	5,940	10,010	9,313	–697	0.386	–269
11	–	–	5,940	5,940	9,313	3,373	0.350	1,181
12	–	–	5,940	5,940	9,313	3,373	0.319	1,076
13	–	–	5,940	5 940	9,313	3,373	0.290	978
14	–	–	5,940	5,940	9,313	3,373	0.263	887
15	1,300	–	5,940	7,240	9,313	2,073	0.239	495
16	–	–	5,940	5,940	9,313	3,373	0.218	735
17	–	–	5,940	5,940	9,313	3,373	0.198	668
18	–	–	5,940	5,940	9,313	3,373	0.180	607
19	–	–	5,940	5,940	9,313	3,373	0.164	553
20	(6,580)	(1,490)	5,610	5,610	17,383	11,773	0.149	1,754

Net present value –2,180

Internal rate of return = $8 + \left(2 \times \frac{2,283}{4,463}\right) =$ 9.02%

Note: [1] Cash inflow is equal to the revenue from the sales of hides and skins (see Table 7 in text) plus the revenue from slaughtering 3,750 livestock units at £2.00 a head. In year 20, residual value of fixed capital and recovered working capital are added to this sum.

Appendix II

Technical notes

DEFINITIONS

For the purpose of this report:

Abattoir – means premises approved and registered by the Authorities, used primarily for the slaughter of animals for human consumption.

Carcase – means the whole body of any slaughtered animal intact or split lengthwise in the approximate medial line of the vertebral column after bleeding, skinning and evisceration, and removal of the head, genitals and also the udders of female animals that have calved.

Cleaning – means the removal of objectionable matter.

Contamination – means the direct or indirect transmission of objectionable matter.

Authority – in relation to an abattoir or establishment, means the official authority charged by the Government with the control of hygiene including meat inspection.

Deep round temperature – carcase temperatures measured by a probe thermometer at bone depth against the neck of the femur in what is commonly known as the deep round.

Dressed or dressing – in relation to:

(a) slaughtered animals except pigs, sheep and lambs, goats and kids, means the removal of the head, hide or skin, viscera, genital organs, urinary bladder, and feet up to the carpal and tarsal joints; and udders of lactating animals, animals that have calved or are in advanced pregnancy.

(b) slaughtered pigs means the removal of hair or bristles or skin, claws, eye lids, viscera, genital organs, urinary bladder, udders in the case of lactating animals, animals that have farrowed or are in advanced pregnancy; and the external acoustic duct unless in respect of that part, an alternative effective form of cleaning is carried out.

(c) sheep and lambs, goats and kids means the removal of the head, the pelt or skin, including that of the head, viscera, genital organs, urinary bladder and feet to the carpal and tarsal joints, and udders of lactating animals, animals that have given birth or are in advanced pregnancy.

(d) cattle and pigs, includes, where necessary, the spliting of the carcase: by dividing the carcase lengthwise along the medial line of the vertebral column.

Edible offal – in relation to slaughtered animals, means such offal as may be passed as fit for human consumption.

Fresh meat – means meat which has not been treated in any way to ensure its preservation, except if it has been subject to refrigeration.

SITING OF ABATTOIRS

Abattoirs may be sited in urban, rural or nominated industrial sites and each has both advantages and disadvantages. Since the advantages of the rural site generally outweigh those of the other sites it is recommended that a rural location be chosen where possible.

Abattoirs should be placed on firm gently sloping land, away from all other buildings, residential areas and factories. The site should be chosen well away from town boundaries (including projected town boundaries) having access to labour, all services (water, electricity, drainage etc) communications (roads, telephone, etc) and preferably served by public transport. The abattoir should be surrounded by a stock-proof fence to keep slaughter stock in and other animals out. The land could be landscaped and planted with trees, to provide wind breaks, shade and shelter, if not to make the building more attractive. Arable farmland should not be chosen as it may be a waste of productive land for the cultivation of crops and may be subject to drift of crop spraying chemicals. Finally, consideration should be given to the direction of the prevailing wind. Abattoirs should be constructed neither to the leeward nor windward of the town. Therefore, if the prevailing winds are north/south, the abattoir should be built to the east or west of the town.

LAIRAGE FACILITIES

In this report, the sizes of the lairages have been based on the following recommendations of the UK Ministry of Agriculture, Fisheries and Food:

Cattle	loose	2.32–2.80 m^2 /animal;
	tied	3.25 m^2 /animal;
Sheep and goats		0.56 m^2 /animal;
Pigs		0.74 m^2 /animal.

As these recommendations relate only to pen sizes, a further 30% has been added for reception areas and passageways. Lairage sizes have been calculated to hold one day's average kill.

For the purpose of this report it has been taken that separate pens and water troughs will be constructed in each of the models for the three stock species. In Models 3 and 4, isolation pens with solid walls have been accounted for. The costing of the general lairage has been based on an open bar construction with impervious non-slip floor with the exception of Model 1, where cattle are to be tied to a bar on hard standing. Shade cover has been costed for all models.

SLAUGHTER FACILITIES

Dimensions

A full list of room dimensions for the Cost Models has been given in Table 1 in Appendix I. Since it is impossible to assess exact sizes for each model without first knowing the system of slaughter to be adopted, recommendations based on animal throughput criteria have not been given. Dimensions have been chosen based on the experience of the authors after discussion with outside bodies closely connected with the slaughter industry. They are to be considered as the minimum dimensions.

Construction

No attempt has been made to present specific layout designs for the four abattoirs as this is not within the scope of the report. Nevertheless, certain building details have had to be assumed in view of their considerable effect on construction costs. Floors should be of impermeable, non-slip, monolithic screed, sloping at 1:50 into screened drains.

The walls, of solid construction, should be finished in a smooth impermeable granolithic screed and be tiled, grouted with an impervious material or covered with an epoxy resin paint designed to function as a 'tile', to a height of not less than 2 metres. Above this level, the walls should be finished in flake free high quality, light coloured lead and arsenic free gloss paint. Ceilings and superstructure should be similarly finished. All floor/wall/ceiling junctures should be rounded or coved.

Overhead rails should be 3.3 metres high for cattle dressing, although 4.5 metres would be required for the bleeding rail. Smallstock and pigs may be slaughtered and dressed from a 3 metre rail. The overall height of the building should take into account the girders and hangers used to support these rails and should be not less than 6 metres at the point of the cattle bleeding. Floor levels should slope in such a way that water and materials on the floor flow into drains from clean to dirty areas. Water should not flow from one room to another.

The building should be constructed to allow maximum light and ventilation. Attention should be paid to preventing entry of birds, insects, vermin, dogs, all other animals (apart from slaughter stock) and unauthorised persons.

Materials used in the construction should be impermeable. Wood, string, cloth, etc should not be used. Stainless steel, galvanised steel, plastic, aluminium (of non-staining type) should be used in preference to absorbant materials. All steelwork liable to rust should be covered with a rubberised paint. Paint liable to flake should not be used.

Window ledges should be sloped so that implements cannot be placed on them and metal window frames should be of the non-rusting type.

Electrical fittings (including switches, sockets and light fittings) should be of the waterproof type. Pipework should be chased into the walls and the exit junctions made of stainless steel. If this is not practicable, all pipework, including electrical conduit should be attached to the walls with spaced pipe hangers.

Equipment

All equipment used in the working areas of the abattoir should have an impervious, smooth finish without corners, welds, rough protrusions or ornamentation which can collect dirt, fat, blood, moisture etc. Bleeding troughs should be made in masonry and should be finished with tile, with an impervious grout, stainless steel or non staining aluminium. Metal equipment should be made of stainless or galvanised steel which should not be painted. Unprotected steel which is liable to corrosion should not be used. Wood should not be used in slaughter halls for any purpose. This includes furniture eg stools and chairs.

Equipment with an electrical supply should have waterproof electrical connections and switchgear.

Slaughter methods

The following slaughter practices have been assumed for the purpose of determining building and equipment costs. Provision has been made in all models for an area or pen for the stunning of livestock. In countries where animals are not stunned prior to sticking, the pen may be replaced with floor or wall rings to tie the animal. Stunning by captive bolt pistol has been assumed for all species in Model 1 but in Models 2–4 pigs should be stunned electrically. Animals should be stuck while in a horizontal position in Models 1 and 2 but vertically in Models 3 and 4 except in cases when animals are not stunned. All animals should be bled in a vertical position from either a hoist or bleed rail.

In Models 1–3 the cattle and smallstock should be lowered to a mobile cradle where the hind legs and mid-line are to be flayed. The thoracic cavity or brisket should be opened by hand saw in this position. In Model 4 these operations should be carried out on the rail. In Models 1 and 2, the carcases should be raised by hoist by inserting

a gambrel in the gams of the hind legs. The carcase should be flayed out in this position and the head and forefeet removed. In Models 3 and 4 these operations should be carried out after hoisting and transfer to the dressing rail. The hides should be lowered into a barrow in all models and taken to the hide room for further processing. The head should be flayed out, washed and hung to drain in the slaughter hall. Later, it should be transferred to the chill room.

Evisceration from a gambrel has been costed in Model 1. In Model 2, the carcase should be transferred to a dressing rail and evisceration carried out cleanly, the viscera being dropped into a barrow or truck and taken to the tripery without delay. In Models 1–3 the pluck should be removed by hand and placed on a hook to one side of the slaughter hall. This should be carried out in Model 4 also but the thoracic cavity will be opened by saw on the dressing rail. The gall bladder should be removed from the liver while it is hanging. The carcase may be split, quartered or left complete as desired and washed by water spraying. Wiper cloths should not be used. In Model 1, the quarters or sides should be removed from the gambrel and placed in hooks in the hanging room. In Models 2–4, the carcases may be rolled in.

Sheep may be handled in the same way as cattle except that in Models 1 and 2 the hoist will not be necessary to bleed or dress the carcase as it is light enough to be lifted to a hook by hand.

Pigs should be slaughtered and dressed in a completely separate slaughter hall away from other slaughter halls, common by-product rooms and hide stores. Pigs should always be stunned. In Model 1 the use of the captive bolt pistol has been recommended but in the other models electric tongs (electrolethaler) should be used. In Models 1 and 2 animals should be stuck horizontally and hoisted, whereas in Models 3 and 4 pigs should be stuck after hoisting. After bleeding, the pigs should be scalded in hot water for 5 minutes at a temperature of 60–63°C. In Models 1 and 2 they should be removed and placed on a table and scraped under sprays of water with a scraping horn or blunt knife to remove the hair. In Models 3 and 4, the carcases should be transferred to a dehairing machine. Once the hairs are removed, the carcases may be hoisted on a gambrel in Model 1 and on to the dressing rail in Models 2–4. The toe nails should be removed and scraping completed by hand or gas flame and the body washed. Evisceration should be carried out immediately using a knife. The viscera should be lowered onto a barrow and the pluck removed by hand and placed on a hook. The gall bladder should be removed from the liver. Upon completion of evisceration the washed carcase should be placed in the hanging room to cool. The plucks, after washing and draining of excess water, should be placed in a hanging room. The tripes should be removed to the tripery and the contents emptied on the first table which has a drain to the outside into a bunker. The empty tripes may be washed on the second table and hung to drain. In Models 3 and 4 they may go on to be rendered or further processed if there is no demand for them by the owners.

CHILLING FACILITIES

The primary aim of providing chilling facilities is to protect carcases against spoilage by micro-organisms which could result in surface slime formation or bone taint in the deep muscle. Refrigeration also gives a measure of protection against other forms of meat deterioration during storage, such as oxidation of the fat, adverse changes in the colour of the superficial tissues and their undue desiccation. However, the risk of spoilage and deterioration of carcase meat is less likely when consumed rapidly after slaughter (ie within 24–36 hours), as happens in many of the rural areas and townships served by abattoirs with low animal throughputs.

To minimise capital expenditure, chilling facilities have not been included in Model 1. A comparative cost analysis has been carried out for Model 2 to show the effect of including refrigeration facilities in the design.

Dimensions

For optimal plant performance, chill rooms should be rectangular, with a width to length ratio of 1:2 and a maximum length of 70 m. Although it is common to chill each species separately because of time/temperature variations in the cooling rate, in this report a common initial chilling room has been recommended for hot beef and mutton carcases to minimise capital expenditure. Under these circumstances control of the refrigeration cycle is essential to ensure the correct heat extraction rate from each species. Carcases must hang so that there is sufficient space between them to allow air to circulate freely. The calculation of hanging room dimensions for the Models has taken into account the following minimum carcase and rail spacing criteria.

	Between rails distance (metres)		Minimum distance between carcases along rails (metres)
	Minimum	Desirable	
Beef	0.9	0.9	0.37
Pigs	0.46	0.7	0.37
Lambs	0.46	0.46	0.30

Ideally there should be a gap of at least 37 cm between carcase surfaces.

A number of smaller rooms for each duty group might be preferred to reduce the period during which chill room doors remain open, speed up chilling, lessen the possibility of meat spoilage during the mixing of hot and cold carcases, and facilitiate the simultaneous loading of rooms and dispatch of chilled meat. In general, individual chill rooms should be sized to suit the throughput of the slaughter line during a period of approximately 2 hours.

In this report, calculations for chiller capacity have been based on a 3-room system as follows:

Room 1 – hot beef and mutton;

Room 2 – chilled beef only;

Room 3 – hot pork.

Hot beef and mutton are to be placed in Chill Room 1 within 1 hour of slaughter. After overnight chilling, the mutton is to be dispatched and the chilled beef passed into Chill Room 2. After 24 hours in Chill Room 2, the beef is to be dispatched.

The size of Room 2 must be increased if longer holding times for the beef are required. Room 3 has been designed to chill pork carcases overnight before dispatch the following morning.

Hanging room	Dimensions (sq metres) Model 2	Model 3	Model 4
Room 1 – Beef and mutton	50 m^2 (10x5)	95 m^2 (13.5x7)	153 m^2 (17x9)
Room 2 – Beef only	41 m^2 (9x4.5)	70 m^2 (7x10)	112 m^2 (16x7)
Room 3 – Pork only	34 m^2 (8x5.4)	63 m^2 (12.5x5)	105 m^2 (15x7)
Condemned/detained carcase room	–	15 m^2 (5x3)	24 m^2 (6x4)

Construction

Doors and frames should be of impervious material such as stainless steel, non-staining aluminium, rubber or reinforced plastic. Doors may be of single or double hinge or sliding. If hinged they should open outwards from the room and fold flat against the wall to avoid causing an obstruction. Doors should be fully insulated.

Although chill rooms should not be subject to extreme wear and tear, the peculiar environment demands a hard wearing surface. Suitable covering for the wall and ceiling includes galvanised steel, stainless steel, or aluminium sheeting. A vapour barrier is necessary to protect the insulation from moisture. Wall seams should be

imperviously bonded and special cove and wall junction pieces fitted. Floors are usually constructed with a granolithic screed laid direct to a concrete base and provided with full drainage.

Walls and ceilings should be fully insulated but floor insulation is usually considered unnecessary unless the plant is designed to operate at temperatures lower than 0°C.

Remote temperature charts have been accounted for in Models 3 and 4.

Refrigeration plant duty

Model 2

Duty room 1: to cool 5,000 kg of beef sides from 38 to 15°C within 20 hours and at the same time to cool 1,000 kg mutton carcases from 38 to 7°C within 12 hours.

Duty room 2: to cool 5,000 kg of beef carcases from 15 to 1°C within 24 hours.

Duty room 3: to cool 3,600 kg of pork carcases from 38 to 10°C within 15 hours.

Model 3

Duty room 1: to cool 10,000 kg beef sides from 38 to 15°C within 20 hours and at the same time to cool 3,000 kg of mutton carcases from 38 to 7°C within 12 hours.

Duty room 2: to cool 10,000 kg beef sides from 15 to 1°C within 24 hours.

Duty room 3: to cool 11,000 kg pork carcases from 38 to 10°C within 15 hours.

Model 4

Duty room 1: to cool 20,000 kg beef sides from 38 to 15°C within 20 hours and at the same time cooling 5,000 kg mutton carcases from 38 to 7°C within 12 hours.

Duty room 2: to cool 20,000 kg beef sides from 15 to 1°C within 14 hours.

Duty room 3: to cool 18,000 kg pork carcases from 38 to 10°C within 15 hours.

All temperatures are measured as deep carcase or deep round temperature.

The air temperature must not fall below −1°C and relative humidity should be maintained between 87–91%. It has been assumed that ambient conditions are 38°C with a relative humidity of 75%. Calculations assume that all condensers are air cooled.

The rate of cooling of carcases depends upon the size and heat capacity of that carcase, the amount of fat covering, the temperature of the chiller and the circulating air velocity over the carcases. Moisture losses or shrinkage of as much as 4% in beef cattle and 5% in lamb can result if the relative humidity is not maintained between 87–91%. For any given condition of chilling, the weight loss from poorly covered carcases will be greater than that from those having a heavy fat cover.

BY-PRODUCT RECOVERY AND TREATMENT

Introduction

In general, the recovery of abattoir wastes and the full utilisation of slaughter by-products, apart from hides and skins, is only commercially practised near the larger mechanised slaughterhouses that sustain high animal throughputs. The installation of fully mechanised by-product recovery and treatment systems necessitates high initial capital expenditure and subsequent running and maintenance costs.

Low cost systems are being developed to use some abattoir by-products which sometimes go to waste in smaller and medium-sized units but for the purpose of this report it has been taken that none is commercially available.

The variety of uses to which certain classes of offals are put in developing countries substantially affects the type of treatment and economic viability of the recovery process. Since it has not been possible to consider inter-regional variations within the scope of this report, a simple rendering process of meat/bone and blood meal has been costed.

Treatment of bone, blood and meat into a meal has not been included in Models 1 and 2 due to the low animal throughput and the relatively high cost of plant and maintenance.

The air drying of cattle hides and sheep skins has been detailed and costed in all of the Cost Models.

Processing of bone, meat and blood meal

Bone, meat and blood may be rendered together using the same equipment or treated separately. If rendered together, care must be taken to ensure that the level of blood in the raw material does not interfere with the action of the digester. At too high proportion, coagulating material is preferentially deposited on the inside walls of the digestor.

It is estimated that 15 kg of blood can be collected from an ox or buffalo, 2 kg from sheep or goats and 4 kg from pigs if bleeding and collection methods are efficient. Blood contains approximately 75–80% water which is evaporated during the process of blood meal manufacture.

The production of blood meal is carried out in two steps:

(a) The blood is pumped into a preheating tank with an agitator where it is subjected to steam at 4.80 bars pressure for 30–40 minutes in order to clot the blood. The water is run off after cooling. The temperature of the product at this stage should not exceed 12°C.

(b) The coagulated material is transferred to a steam jacketed digester where further injection of live steam takes place. After heating to not more than 120°C for 2 hours to effect drying and sterilisation, blood meal may be removed and spread onto a concrete floor to cool before bagging.

Bone meal is useful as a fertiliser and as stock feed in the form of a cattle lick. A loss of about 50% in the weight of green bones and 25–30% in dry bones is encountered in the manufacture of bone meal, the loss being due to fats and oils contained in the bone substance.

Bones are first crushed then removed to a steam jacketed digester which has a revolving agitator equipped with paddles to mix the meal during cooking. This agitator is hollow and allows steam to pass onto the meal. In this process, the bones are subjected to live steam at 2.75–4.12 bars pressure for a minimum of 2 hours (to sterilise). Water vapour is vented from the digester. After 2 hours the steam is turned off and the bones emptied into a centrifuge where the water and fat are removed. They are then emptied onto a concrete floor to cool and dry. After drying, the bones are removed to a hammer mill for grinding, sifting and bagging.

Meat meal is produced from muscle and meat offals from which all bone has been removed and may be used as either fertiliser or animal feed.

The raw material is processed in a steam jacketed digester as described above for bones with steam at 4.8–5.5 bars pressure for 4.5–5 hours to effect sterilisation. Fat and tallow present in the products should be removed to avoid subsequent rancidity to finished meal.

The molten fat is removed by centrifugation and collected in tanks for storage. After removal of the fat, the meat meal can be spread on a concrete floor to cool and dry before milling and bagging.

Although certain classes of condemned carcases and offals can be processed into carcase meal using the same method as that described for meat meal, such processing has not been recommended in this report in view of the possible incidence of animal diseases which may not be destroyed by these processing methods. It is recommended that all condemned material is destroyed by incineration or burying in a lime pit (see below, 'Condemnation and inspection').

The air drying of hides and skins

Unless it is possible to commence tanning within a few hours of flaying, some form of preservation must be carried out to prevent putrification.

The simplest and least expensive treatment for raw hides and skins in hot, dry conditions is to air dry them. This can reduce the hide moisture content to about 12% at which level bacterial action is greatly reduced.

Residual flesh should be removed from the hides to prevent rapid bacterial growth and rancidity before drying. The hides should then be stretched in frames orientated in line with the prevailing wind under shelter to prevent spoilage due to direct sunlight and rain. Covered areas and stretching frames have been accounted for in each of the Cost Models.

CONDEMNATION AND INSPECTION

No animal should be slaughtered for the production of meat or meat products unless it has been inspected before slaughter and found healthy by qualified persons. Animals showing signs of sickness should be separated from all others and must be slaughtered separately.

Costs to cover the installation of emergency slaughter rooms have been made for Models 2, 3 and 4 together with an incinerator for the destruction of all condemned material. Because of the low animal throughputs and therefore low expected incidence of condemned livestock, the inclusion of a separate slaughter area was not considered necessary for Model 1. In this model, sick animals should, however, be killed separately, at the end of normal production and if condemned, all offals, by-products and carcase meat buried in a lime pit without allowing it to come into contact with materials from healthy animals.

Slaughter floors and equipment should be thoroughly washed after any emergency slaughter.

Post-mortem inspection should be made when the carcase is being dressed and until such time as the inspectors complete it, all parts of the carcase and offals should be identifiable with the carcase. In the two smaller models, the inspector may examine carcases, plucks, heads, tripes etc, at the end of a days production but before dispatch. However, it is recommended that the inspector be present during slaughter to ensure that production is carried out in an hygienic manner.

On-site laboratories and refrigerated hanging rooms for the detention of suspect carcases have been provided in Models 3 and 4. In Models 1 and 2 condemned carcases and offals should be buried or incinerated directly.

If any portion of the carcase or offal taken from it is rejected as unfit for human consumption it should be destroyed by either incineration as in Models 2, 3 and 4 or by burying in lime in the case of Model 1.

HYGIENE AND SANITATION

In all models, the slaughtering and dressing area should be arranged to ensure that meat will not be contaminated by dirty material arising from the process of slaughter-

ing and dressing. The premises should be designed so that all operations may be carried out in hygienic conditions.

Facilities have been costed for the emptying and cleaning of stomachs and intestines in areas effectively separated from the slaughter and dressing halls and from any place where meat and offals are handled or kept.

It has been assumed in the costing of building materials etc, that all walls are faced with a hard and impervious material to a height of not less than 2 metres from the floor, to facilitate cleaning. Exposed beams, girders and roof spaces should as far as possible have smooth surfaces to prevent the accumulation of dirt and ease washing. It has been assumed that the floors of slaughter halls, hanging rooms, meat or by-product storage rooms, condemned meat rooms, etc, will be of impervious non-slip material, laid so as to enable them to be thoroughly cleaned. Slaughter hall floors should be laid to have a minimum slope of 1 in 50 to effective drains or gutters.

Construction costs have taken into account the need to prevent, as far as possible, the entry of rodents, insects, birds and stray animals. 'Insectocutors' have been recommended for Models 3 and 4.

Hand washing facilities with hot and cold running water have been detailed for slaughter halls, work rooms and in all lavatories. Soap, nail brushes and disposable hand towels, all of which have been costed, should be provided, and staff encouraged to use these facilities. Direct access between lavatory facilities and working areas has been prevented as far as possible.

Steam cleaners and knife sterilisers (at 82°C) have been accounted for in Models 2–4 and the provision of detergents and cleaning equipment made for each model. The set-up and maintenance of a rigid cleaning schedule should be encouraged.

Changes of overalls and aprons between each shift or per day in the case of Model 1, have been accounted for in the running and operational costs. Personnel should be encouraged to wear suitable protective clothing, including head covering and footwear.

Laundry rooms have been included in Models 2, 3 and 4 and the provision of clean overalls should be the responsibility of the slaughter house management.

PERSONNEL AREAS AND GENERAL AMENITIES

Adequate provision has been made in each of the models for lavatory and changing-room accommodation, for both sexes if necessary, situated conveniently for personnel working on the premises, based on a sliding scale of approximately one urinal or WC and one wash hand basin for every four members of staff. Showers have been accounted for in each of the models.

Mess areas have been costed and recommended for Models 2, 3 and 4, where staff may rest and eat during meal breaks. Facilities for boiling water, washing up and crockery storage have been accounted for.

First-aid facilities have been detailed for each model but a separate room with couch and medical cabinet was not considered justified for Model 1. A first-aid box, fully equipped and regularly maintained has been recommended for Model 1, to be kept in the staff changing room.

General offices and reception areas and accommodation for the exclusive use of veterinary inspectors and meat inspection staff have been accounted for in Models 3 and 4.

WATER AND EFFLUENT TREATMENT

On-site water storage sufficient for 1 days normal consumption has been provided for each of the Models. Water consumption has been calculated using the following criteria:

455 litres/day/pig
273 litres/day/cattle
45 litres/day/smallstock

An extra 25% capacity has been added to the total for contingencies.

The nature of the water supply determines the extent of the treatment required before it can be considered suitable for abattoir use. A heavily polluted supply containing considerable amounts of organic matter would require full treatment including sedimentation (with or without flocculation), filtration and finally chlorination. Clear water from deep wells may not require sedimentation or filtration.

Chlorination plants have been costed for Models 2, 3 and 4 and the addition of chlorine tablets to the water storage tanks has been recommended for Model 1, in order to minimise the maintenance costs.

Waste waters from killing operations contain a high proportion of coarse suspended matter and fat and these are generally removed during pre-treatment. Wire screens to remove materials such as hair, flesh, paunch and manure have been accounted for in all models. Grease and fat is removed by conventional traps and these have been included in the costs of all models.

Even after the removal of suspended solids and colloidal materials, a substantial amount of organic matter in solution will remain and this is normally removed by biological treatment. Two types of biological systems might be used, either an aerobic process or a septic tank and 'French-trench' system.

A choice of secondary treatment of effluents depends on many factors and the final decision must rest with the controlling authority. The cost of an aerobic process for secondary treatment has been given for Models 3 and 4. Expenditure for such a plant was not considered justified for Models 1 and 2.

MANAGEMENT AND MANPOWER

Management

Although there are many different forms of management in abattoirs, (usually depending on the function, ownership and control of them in the industry), they usually fall into two categories:

(a) butchers slaughtering their own animals, paying a fee to cover at least the cost of maintenance of buildings.

(b) butchers handing over the animals to an organisation who slaughter the animals for them charging a fee to the butcher. Alternatively, it may be publicly or privately run, by buying and slaughtering animals and then selling the products in carcase, primal or retail joint form.

System (a) above is not recommended since there is likely to be little control over hygienic practices. Nevertheless, with the low production of Model 1 and the high level of organisation required to adminster the slaughter fee, staff etc it is expected that system (a) will be followed in this case. As the two systems are radically different and since comparisons between models cannot be made without the standardisation of abattoir management, this report assumes that system (b) will be used for all four models. Finally, if system (a) is to be used for Models 2, 3 or 4, a bay system of slaughter will have to be used. This would require a much larger building, with corresponding increases in cost of the project.

Manpower

Table 2, Appendix I shows the levels of manpower required to operate each Cost Model under the management system described above. In Model 1, it is expected that all five staff would simply organise themselves to carry out the work. In Model 2 the staff would be divided so that four slaughtermen and two labourers would organise themselves for cattle and smallstock, and three slaughtermen and one labourer for pigs. In Model 3, it is expected that all staff will perform specific duties. For example, two men to work in the lairage and slaughter, one to flay, one to eviscerate and two to handle by-products from cattle and smallstock, and in the pig line, two for lairage/ slaughter, one dehairing, one eviscerating and two in the by-products. The labourers may bring animals from the lairage and clean tripes, fetch and carry, releasing three slaughtermen to work on the animals themselves. In Model 4, complete division of duty into duty stations are envisaged. Essentially, this means one man to a specific job or series of jobs. The management of this system will depend on the skill of the men, the design of the abattoir, type of animal etc.

Finally, this report sets out to identify the slaughter fees which would need to be charged under this particular system of management and manpower. Any variations would affect the slaughter fee. If, however, the abattoir is to be run as a private organisation, the slaughter fee quoted in the body of this report would be applicable to the actual cost of the slaughter to the owner and his mark-up must be of that order to break even.

Appendix III

List of items of capital equipment

In order to keep the size of this report reasonable, not all items of equipment necessary for the function of small and medium sized abattoirs have been included. In the estimation of equipment costs, a percentage has been added to cover these omissions. Further, some countries which have specific slaughter requirements may need specialised equipment other than that described. For example, in some Moslem countries a casting pen is used. Adjustments to the list will have to be made accordingly which may marginally affect the financial analyses.

Those items of equipment with a life of 1, 2 and 3 years have been included here but for purposes of costing have been included in annual operating costs as 'other items of operating equipment' (row 14, Table 5) where, for those items with a life of 2 or 3 years, the replacement cost has been reduced to an annual average basis.

MODEL 1

	Item (a)	No (b)	Life (years) (c)	Foreign (F) or Local (L) (d)	Erection cost (E) (e)
A	**Lairage**				
	Cattle				
	Holding rail	1	2	L	E
	Water trough	1	5	L	E
	Smallstock				
	Gates for pens	2	5	L	E
	Water trough	2	5	L	E
	Pigs				
	Gates for pens	2	5	L	E
	Water trough	2	5	L	E
	General				
	Hose pipe	1	2	F	–
	Wheelbarrow	1	2	F	–
	Shovel	1	2	F	–
	Liveweight scales (optional; not costed)				
B	**Vehicle hygiene**				
	Hosepipe	1	2	F	–

	Item	No	Life (years)	Foreign (F) or Local (L)	Erection cost (E)
C	**Slaughterhall**				
	Cattle and smallstock				
	Drag chain and tie hook (cattle)	2	10	F	—
	Captive bolt pistol	1	10	F	—
	Cartridges (5,000 a year)			F	—
	Blood bins	2	3	F	—
	Mobile cradle	1+2	10	F	—
	Block and tackle	1	10	F	—
	Gambrel collapsible	1	10	F	—
	Hide horse	1	5	L	—
	Offal bins	2+1	10	F	—
	WHB/soap dispenser	1	10	F	E
	Drag chain and tie hook (sheep)	2	10	F	—
	Smallstock gambrel	30	10	F	—
	Hooks	5	10	F	—
	Weigh scales (spring balance)	2	5	F	—
	Hanging hose lines	2	2	F	—
	Knives — sticking	3	2	F	—
	Knives — flaying	4	2	F	—
	Cleaver	1	3	F	—
	Splitting saw (hand)	1	3	F	—
	Meat hooks S type				
	Large	15	10	F	—
	Small	50	10	F	—
	Pigs				
	Captive bolt pistol	1	10	F	—
	Cartridges (4,000 a year)			F	—
	Blood bin	1	3	F	—
	Scald tank 2 x 1 metre)	1	20	F	E
	Scraping table (stainless steel)	1	10	F	—
	Scraping knives	2	2	F	—
	Scraping horns	2	2	F	—
	Blow lamp (gas type)	1	3	F	—
	Offal bins	2	10	F	—
	WHB/soap dispenser	1	10	F	E
	Pig shackles	2	10	F	—
	Gambrels	30	10	F	—
	Gambrel trolley	1	10	F	—
	Weigh scale (spring balance)	1	5	F	—
	Cleaver	1	2	F	—
	Washing brush	1	5	F	—
	Hand saw	1	3	F	—
	Knives	5	2	F	—
	(Clock)	(1	5	L)	
	General				
	Whetstone	1	10	F	—
	Oilstone	1	2	F	—
	Nailbrush, towels etc	—	1	L	—
D	**Hanging rooms**				
	Cattle and smallstock				
	Hanging beams	5	20	L	E
	Beam supports	15	20	L	E
	Hooks	20	10	F	—

	Item	No	Life (years)	Foreign (F) or Local (L)	Erection cost (E)
D	**Hanging rooms**—*contd*				
	Pigs				
	Hanging beams	2	20	L	E
	Beam supports	6	20	L	E
	Hooks	15	10	F	—
E	**Offal room**				
	Cattle and smallstock				
	Pluck sprinkler	1	5	F	E
	Head washer hose	1	2	F	—
	Tripe table (stainless steel)	1	15	F	—
	Manure trailer	1	5	F	—
	Wall hooks	50	10	F	—
	Hose pipe	1	2	F	—
	Pigs				
	Pluck sprinkler	1	5	F	E
	Hose pipe	1	2	F	—
	Tripe table (stainless steel)	1	15	F	—
	Manure trailer	1	5	F	—
	Wall hooks	30	10	F	—
F	**Hide shelter**				
	Hide frames	50	5	L	E
G	**Water and sewage**				
	Water storage tank (12,000 litres)	1	20	F	E
	Fat screens	2	20	L	—
	Septic tank	1	20	L	E
	Clog-free drain covers	5	20	F	—
	Chlorine tablets (120,000 a year)			F	—
H	**Personnel areas**				
	Showers	2	10	F	E
	Toilet and urinals	2+2	10	F	E
	WHB (stainless steel)	2	10	F	E
	Lockers	4	20	L	—
	Knives	12	2	F	—
	Scabbards	4	5	F	—
	Hats	4	10	F	—
	Overalls	20	2	F	—
	Boots	6	3	F	—
	Aprons	12	2	F	—
I	**First aid facilities**				
	First aid kit	2	5	F	—
J	**Office/store**				
	Scrapers/brooms	4	2	L	—
	Table	1	20	L	—
	Chair	1	10	L	—

	Item (a)	No (b)	Life (years) (c)	Foreign (F) or Local (L) (d)	Erection cost (E) (e)
A	**Lairage**				
	Cattle and smallstock				
	Gates for pens	8	5	L	E
	Water troughs	8	5	L	E
	Pigs				
	Gates for pens	11	20	L	E
	Water troughs	10	5	L	E
	General				
	Hanging hose lines	3	2	F	–
	Mortality hoist (block and tackle)	1	10	F	–
	Mobile cradle	1	10	F	–
	Wheelbarrow	1	2	F	–
	Shovel	2	2	F	–
B	**Vehicle hygiene**				
	Pressure hose	1	2	F	–
C	**Slaughterhall**				
	Cattle and smallstock				
	Drag chain and tie hook	2	1	F	–
	Captive bolt pistol	1	10	F	–
	Cartridges (18,750 a year)			F	–
	Blood bins	2	3	F	–
	Power hoist-push travel beam	1	5	F	E
	Mobile cradle	1+2	10	F	–
	Block and tackle	1	10	F	–
	Gambrel collapsible	1	10	F	–
	Transfer pole	1	5	F	–
	Head work-up table	1	10	F	–
	Offal bins/paunch truck	3+1	10	F	–
	Knife sterilisers/WHB/soap dispensers (stainless steel)	2	10	F	E
	Double railage, including hanging room	99 metres	50	F	E
	Inspection railage	3 metres	50	F	E
	Double rail rollers	150	30	F	–
	Beef shackle	2	5	F	–
	Roller hooks/chains	120	10	F	–
	Small stock extension chain	10	10	F	–
	Small stock gambrel	50	10	F	–
	Small stock carrier	5	20	F	–
	Head carrier	1	20	F	–
	Working platform	1	20	F	–
	Spray nozzle	1	5	F	–
	Knives – sticking	3	2	F	–
	Knives – flaying	2	2	F	–
	Cleaver	2	3	F	–
	Power splitting saw	1	5	F	–
	Meat hooks, S type				
	Large	40	10	F	–
	Small	100	10	F	–

	Item	No	Life (years)	Foreign (F) or Local (L)	Erection cost (E)
C	**Slaughterhall**—*contd*				
	Pigs				
	Pig stunning pen (brickwork in building cost)	1	—	—	—
	Electrolethaler	1	10	F	E
	Electrolethaler tongs	1	5	F	—
	Electric hoist	1	5	F	E
	Bleed trough } built-in	1			
	Blood tank } built-in	1			
	Scald tank (1.83 metres × 1.53 metres)	1	20	F	E
	Block and tackle	1	10	F	—
	Gambrel table	1	20	F	—
	Scraping table (stainless steel)	1	20	F	—
	Scraping knife	2	2	F	—
	Scraping horns	2	2	F	—
	Blow lamp gas type	2	3	F	—
	Offal bins/trucks	3	10	F	—
	Knife sterilise/WHB/soap dispenser (stainless steel)	2	10	F	E
	Bleed railage, including spiral descender	4.6 metres	20	F	E
	Dressing and refrigeration railage	53.4 metres	20	F	E
	Pig shackles	5	10	F	—
	Gambrels (0.534 metres over points)	100	10	F	—
	Gambrel trolley	1	10	F	—
	Spray nozzle	1	5	F	—
	Washing brush	1	2	F	—
	Cleaver	1	3	F	—
	Handsaw	1	2	F	—
	Knives	5	2	F	—
	Meat hooks, S type				
	Large	10	10	F	—
	Small	10	20	F	—
	(Clock)	(1	20	L	E)
	Emergency slaughterhall				
	Block and tackle	1	10	F	—
	Bleed bin	1	3	F	—
	Cradle	1	10	F	—
	Scald tank (1.53 metres X 0.92 metres)	1	10	F	E
	Offal truck	1	10	F	—
	Knife steriliser (stainless steel)	1	10	F	E
	Dressing rail	3 metres	30	F	E
	Working table	1	10	F	—
	Shackles	2	5	F	—
	Accessories to slaughterhalls				
	Whetstone	1	10	F	—
	Oilstone	2	2	F	—
	Nailbrush, towels etc	—	1	F/L	—

	Item	No	Life (years)	Foreign (F) or Local (L)	Erection cost (E)
D	**Hanging room**				
	Railage included in C above				
	Cold stores:				
	Room 1: 40.9 sq metres/94 cu metres 22, 644 BTU's/hour		30	F	E
	Room 2: 34.1 sq metres/67.8 cu metres 17, 660 BTU's/hour		30	F	E
	Room 3: 27.7 sq metres/61.6 cu metres		30	F	E
E	**Offal room**				
	Pluck sprinkler	1	5	F	E
	Head washer	1	10	F	E
	Tripe table (stainless steel)	1	15	F	E
	Manure bin	2	10	F	—
	S hooks	250	10	F	—
	Intestine bin	2	10	F	—
	Hose pipe (included)	2	—	F	—
	Hide frame	150	5	F	E
	Hide shelter (included with frame)	—	—	—	—
F	**By-products**				
	No blood/bone meal				
G	**Condemnation**				
	Mobile cradle	1	10	F	—
	Incinerator	1	20	L	E
	Hoist (block and tackle)	1	10	F	—
H	**Water and sewage**				
	Water storage tank	41,000 litres	20	F	E
	Electric pump	1	10	F	E
	Chlorination plant	1	10	F	E
	Septic tank	1	20	L	E
	Fat screens	3	20	L	—
I	**Personnel**				
	Shower	2	10	F	E
	Toilet/urinal	1+2	10	F/L	E
	WHB (stainless steel)	2	10	F	E
	Lockers	12	20	L	—
	Knives	20	2	F	—
	Scabbards	14	5	F	—
	Hats	45	2	F	—
	Overalls	45	2	F	—
	Boots (pair)	15	3	F	—
	Aprons	30	2	F	—
	Bench	1	10	L	—

Model 2—contd

	Item	No	Life (years)	Foreign (F) or Local (L)	Erection cost (E)
J	**Office**				
	Desk	1	20	L	—
	Chair	2	20	L	—
	Filing cabinet	1	20	F	—
	Laundry cupboard	1	20	L	—
K	**Mess room**				
	Tables	2	20	L	—
	Benches	4	20	L	—
	Sink (stainless steel)	1	20	F	E
	Hot plate	1	10	F	—
L	**General**				
	Mobile pressure washer	1	10	F	—
	Scraper, brooms etc.	2	2	L	—
	Standby electricity generator	1	30	F	E
	First aid kit	1	5	F/L	—

MODEL 3

	Item (a)	No (b)	Life (years) (c)	Foreign (F) or Local (L) (d)	Erection cost (E) (e)
A	**Lairage**				
	Cattle and small stock				
	Gates for pens (open bar)	12 sets	20	F	E
	Water troughs	11	5	F	E
	Pigs				
	Gates for pens (plated)	16 sets	20	F	E
	Water troughs	15	5	F	E
	Slapmarker	1	10	F	—
	General				
	Hanging hoselines	3	5	F	—
	Mortality hoist	1	5	F	E
	Mobile cradle	1	10	F	—
	Liveweight scales	2	20	F	—
B	**Vehicle hygiene**				
	HP steam/water hose	1	2	F	—

	Item	No	Life (years)	Foreign (F) or Local (L)	Erection cost (E)
C	**Slaughter hall**				
	Cattle and small stock				
	Anti back-up gate (vertical)	1	10	F	E
	Knocking box	1	10	F	E
	Captive bolt pistol	2	10	F	—
	Cartridges (50,000 a year)	—	—	F	—
	Bleed trough (brick — 4.3 metres)	1	30	L	
	Blood tank	3	30	L	
	Autolander hoist	1	10	F	E
	Friction dropper	1	10	F	E
	Mobile cradle (cattle)	2	10	F	—
	Mobile cradle (small stock)	3	20	F	—
	Electric hoist	1	10	F	E
	Transfer pole	1	5	F	—
	Head working table	1	10	F	—
	Evisceration table (stainless steel)	1	10	F	—
	Working platforms	3	20	F	—
	Saw platform	1	20	F	E
	Electric saw	1	5	F	—
	Offal bins/paunch tracks	10+3	10	F	—
	Knife sterilisers/WHB/soap dispensers (stainless steel)	5	10	F	E
	Flat-bed railage (bleeding)	6.1 metres	20	F	E
	Double railage (including refrigeration)	168.4 metres	50	F	E
	Inspection railage	7.6 metres	50	F	E
	Autolander rollers	5	5	F	—
	Double railage rollers	250	30	F	—
	Beef shackles	5	5	F	—
	Small stock shackles	15	5	F	—
	Roller hooks/chains	300	10	F	—
	Small stock gambrels	250	10	F	—
	Small stock carriers	30	20	F	—
	Extension chains (small stock)	100	10	F	—
	Weigh scale	1	20	F	E
	Hanging hose lines	4	5	F	—
	Knives	20	2	F	—
	Cleavers	2	3	F	—
	Hand saws	2	3	F	—
	Meat hooks, S type				
	Large	200	10	F	—
	Small	500	10	F	—
	Swivel hooks	60	10	F	—
	Spray nozzles	2	5	F	—
	Emergency slaughter				
	Drag chain and hook	1	1	F	—
	Railage (double track)	3 metres	30	F	E
	Rollers and chains	5	20	F	—
	Hand hoist (block and tackle)	1	10	F	—
	Hand saw	1	3	F	—
	Offal bins/paunch trucks	2	10	F	—
	Bleed bin	1	3	F	—

	Item	No	Life (years)	Foreign (F) or Local (L)	Erection cost (E)
C	**Slaughter hall**—*contd*				
	Knife steriliser/WHB/soap dispensers (stainless steel)	1	10	F	E
	Knives	5	2	F	—
	Pigs				
	Pig stunning pen (brickwork in building cost)	(2.4 metres × 3.0 metres)			—
	Electrolethaler	1	10	F	E
	Electrolethaler tongs	2	5	F	—
	Elevator	1	10	F	E
	Blood trough (brickwork — built in)	1			—
	Blood tank (brickwork — built in)	2			—
	Pig dropper	1			—
	Scald tank (1.83 metres x 1.53 metres)	1	20	F	E
	Electric hoist to dressing rail (automatic — hoist and hinged rail)	1	10	F	E
	Dehairing machine (hand cradle)	1	10	F	E
	Beaters	1	2	F	—
	Gambrel table	1	10	F	—
	Gas flame gun	1	3	F	—
	Viscera table (stainless steel)	1	10	F	E
	Offal trucks	4	10	F	—
	Knife sterilisers/WHB/soap dispensers (stainless steel)	4	10	F	E
	Bleeding railage (including spiral descender)	9.2 metres	30	F	E
	Dressing and refrigeration railage	97 metres	30	F	E
	Inspection railage	4.6 metres	30	F	E
	Shackle return rail	4.6 metres	30	F	E
	Pig shackles	10	10	F	—
	Gambrels (0.534 metres over points)	175	10	F	—
	Gambrel trolley	2	20	F	—
	Weigh scale	1	20	F	E
	Hanging hose lines	3	2	F	—
	Spray nozzles	2	5	F	—
	Washing brush	2	2	F	—
	Cleavers	4	3	F	—
	Hand saws	2	2	F	—
	Knives	15	2	F	—
	Lights hooks	50	20	F	—
	Meat hooks, S type				
	Large	10	10	F	—
	Small	25	10	F	—

	Item	No	Life (years)	Foreign (F) or Local (L)	Erection cost (E)
C	**Slaughter hall**—*contd*				
	Emergency slaughter				
	Block and tackle	1	10	F	—
	Bleed bin	1	3	F	—
	Scald tank (1.53 metres x 0.92 metres)	1	10	F	—
	Scraping table	1	10	F	—
	Offal truck	1	10	F	—
	Lights hooks	1	20	F	—
	Knife sterilisers/WHB/soap dispenser (stainless steel)	1	10	F	E
	Dressing rail	1.83 metres	30	F	E
	Working table (galvanised)	1	5	F	—
	Accessories to slaughter halls				
	Whetstone	1	10	F	—
	Oilstone	2	2	F	—
	Nailbrush, towels etc	—	1	F/L	—
	Clock	2	20	F/L	E
D	**Hanging room**				
	Railage included in C above				
	Cold stores:				
	Room 1: 82 sq metres/ 191 cu metres 45, 754 BTU's/hour		30	F	E
	Room 2: 62 sq metres/ 144, cu metres 24, 553 BTU's/hour		30	F	E
	Room 3: 58 sq metres/ 133 cu metres 40, 230 BTU's/hour		30	F	E
E	**Offal room**				
	Pluck sprinkler	2	5	F	E
	Preparation table (stainless steel)	2	10	F	—
	S hooks	500	10	F	—
	Tripe tables (stainless steel)	4	15	F	—
	Tripe washer	2	10	F	E
	Manure trucks	5	10	F	—
	Tripe containers	2	10	F	—
	Intestine puller	1	10	F	E
	Intestine cleaner/strippers	3	10	F	E
	Grading table	1	20	F	—
	Salting table (plastic or stainless steel)	1	20	F	—
	Curing barrels (plastic/wood casks)	14	10	F	—
	Waste bins (galvanised)	2	3	F	—
	Salt bins (stainless steel)	1	10	F	E
	Head washer	1	10	F	E
	Hide frames	450	5	L	E
	Pallets	10	2	L	—
	Weigh scales	1	20	F	—

Model 3—contd

	Item	No	Life (years)	Foreign (F) or (Local (L)	Erection cost (E)
F	**By-products**				
	Pressure melter (No 1) 0.75 tonne	1	20	F	E
	Electric centrifuge plus basket 1.22 metres, 182 kg	1	20	F	E
	Fat tank percolating	1	20	F	E
	Fat tank settling	2	20	F	E
	Fat pump	1	10	F	E
	Containers	1	10	F	—
	Milling/bagging machine	1	20	F	E
	Scales	1	20	F	—
	Hoist	1	5	F	E
	Hoof scald tank (500 litres)	1	10	F	E
	Hoof scraping table	1	20	F	—
G	**Condemnation**				
	Incinerator	1	10	F	E
	Hoist (block and tackle)	1	10	F	—
	Ash box	1	10	F	—
	Meat cradle	1	20	F	—
H	**Water and sewage**				
	Water				
	Water storage tank (113, 650 litres)	1	20	F	E
	Electric pump (206 litres/hour)	1	10	F	E
	Chlorination plant	1	10	F	E
	Steam generator (plus piping, insulation, spares, accessories, fuel storage, 12 steam hose points)	1	10	F	E
	Effluent				
	Effluent, solid screens	4	10	F	E
	grease traps	2	10	L	E
	Aerobic treatment plant	1	30	F/L	E
I	**Personnel**				
	Showers	3	10	F	E
	Toilet/urinals	2+3	10	F	E
	WHB (stainless steel)	2	10	F	E
	Lockers	4	20	L	—
	Stores (clothes)	1	20	L	—
	Knives	40	2	F	—
	Scabbards	20	5	F	—
	Hats	60	2	F	—
	Overalls	60	2	F	—
	Boots (pair)	20	3	F	—
	Aprons	40	2	F	—
	Benches	2	10	L	—
J	**Hygiene**				
	Scrapers, brooms etc	6	2	F	—

Model 3—contd

	Item	No	Life (years)	Foreign (F) or Local (L)	Erection cost (E)
K	**Laundry**				
	Stainless steel sinks	2	10	F	E
	Boiler (clothes)	1	10	F	E
L	**Office**				
	(2 offices and 1 office area, lairage)				
	Desks	3	20	L	–
	Chairs	5	10	L	–
	Safe	1	20	F	E
	Equipment (various) (£920)	–	20	F	–
M	**Mess room**				
	Tables	3	20	L	–
	Benches	6	10	L	–
	Hotplate	2	10	F	–
	Sink (stainless steel)	1	15	F	E
	Urn	1	10	F	–
	Store cupboard	1	20	L	–
N	**General**				
	Insectocutor	8	10	F	E
	Fans	6	10	F	E
	Standby electricity generator	1	30	F	E
	Fencing	256 metres	10	F/L	E
	Tractor (mini)	1	10	F	
O	**First aid room**				
	Couch	1	20	L	–
	Blanket	2	10	F/L	–
	Chair	1	10	L	–
	First aid cabinet	1	10	F/L	–
	Sink (stainless steel)	1	20	F	E
	Refrigerator	1	20	F	–
	Pillow	1	10	F/L	–

MODEL 4

	Item (a)	No (b)	Life (years) (c)	Foreign (F) or Local (L) (d)	Erection cost (E) (e)
A	**Lairage**				
	Cattle and smallstock				
	Gates for pens (open bars)	20 sets	20	F	E
	Water troughs	20	5	F	E

	Item	No	Life (years)	Foreign (F) or Local (L)	Erection cost (E)
A	**Lairage**—*contd*				
	Pigs				
	Gates for pens (plated)	26 sets	20	F	E
	Water troughs	26	5	F	E
	Slapmarker	1	10	F	—
	Electric goad	1	10	F	—
	General				
	Hanging hoselines	6	2	F	—
	Mortality hoist	1	5	F	E
	Mobile cradle	2	10	F	—
	Liveweight scales	2	20	F	—
B	**Vehicle hygiene**				
	HP steam/water hose	1	2	F	—
C	**Slaughterhall**				
	Cattle and smallstock				
	Anti back-up gates	1	10	F	E
	Sheep pen doors (one door plus one gate)	1	20	F	E
	Cattle stunning box	1	10	F	E
	Captive bolt pistol	2	10	F	—
	Cartridges (87,500 a year)	—	—	F	—
	Bleed trough (built-in, 6.1 metres)	1	—	—	—
	Blood tank (built-in)	4	—	—	—
	Autolander hoist	1	10	F	E
	Transfer hoist	1	10	F	E
	Head working table	1	10	F	—
	Evisceration table (mobile)	1	20	F	E
	Working platforms	6	20	F	—
	Saw platform	1	20	F	E
	Electric saw	1	5	F	—
	Knife sterilisers/WHB/soap dispenser (stainless steel)	10	10	F	E
	Flat-bed railage (bleeding)	9.2 metres	10	F	E
	Double railage (including refrigeration)	257 metres	50	F	E
	Inspection railage	12 metres	50	F	E
	Autolander rollers	10	5	F	—
	Double railage rollers	500	30	F	—
	Beef shackles	10	10	F	—
	Small stock shackles	30	5	F	—
	Roller hooks/chains	450	10	F	—
	Small stock gambrels	250	10	F	—
	Small stock carriers	45	20	F	—
	Extension chains	200	10	F	—
	Weigh scale	1	20	F	E
	Leg spreader	1	10	F	E
	Lights inspection/carriers	65	10	F	—
	Head carriers	25	10	F	—

	Item	No	Life (years)	Foreign (F) or Local (L)	Erection cost (E)
C	**Slaughter hall**—*contd*				
	Hanging hose lines	8	2	F	—
	Knives	20	20	F	—
	Hand saws	8	2	F	—
	Cleavers	2	3	F	—
	Meat hooks, S type				
	Large	400	10	F	—
	Small	1000	10	F	—
	Swivel hooks	120	10	F	—
	Spray nozzles	4	5	F	—
	Emergency slaughter				
	Drag chain and hook	1	1	F	—
	Railage (double track)	3 metres	30	F	E
	Rollers and chains	5	20	F	—
	Hand hoist (block and tackle)	1	10	F	—
	Hand saw	1	3	F	—
	Offal bins/paunch trucks	2	10	F	—
	Bleed bin	1	3	F	—
	Knife steriliser/WHB/soap dispenser (stainless steel)	1	10	F	E
	Knives	5	2	F	—
	Pigs				
	Pig stunning pen (brickwork-built in)	—	—	—	—
	Electrolethaler	1	10	F	E
	Electrolethaler tongs	2	5	F	—
	Captive bolt pistol	1	10	F	—
	Elevator	1	10	F	E
	Blood trough (built-in, 4.9 metres)	1	—	—	—
	Blood tank (built-in)	3	—	—	—
	Pig dropper	1	10	F	E
	Scald tank (3 metres x 1.53 metres)	1	10	F	E
	Dehairing machine	1	10	F	E
	Beaters	1 set	2	F	E
	Gambrelling table	1	10	F	—
	Electric hoist to dressing rail (hoist and hinged rail)	1	10	F	E
	Flame gun	1	3	F	—
	Viscera table (stainless steel — 2.4 metres x 0.6 metres)	1	10	F	—
	Offal trucks	6	10	F	—
	Knife sterilisers/WHB/soap dispensers (stainless steel)	8	10	F	E
	Electric saw	1	5	F	—
	Bleeding railage	9.2 metres	20	F	E
	Dressing and refrigeration railage	146 metres	30	F	E
	Inspection railage	7.6 metres	30	F	E
	Shackle return rail	7.6 metres	30	F	E

	Item	No	Life (years)	Foreign (F) or Local (L)	Erection cost (E)
C	**Slaughter hall**—*contd*				
	Pig shackles	20	10	F	—
	Gambrels	500	10	F	—
	Gambrel trolley	4	20	F	—
	Weighscale	1	20	F	E
	Hanging hose-lines	5	2	F	—
	Spray nozzles	2	5	F	—
	Washing brushes	2	2	F	—
	Cleavers	4	3	F	—
	Hand saws	4	2	F	—
	Knives	30	2	F	—
	Lights hooks	85	20	F	—
	Meat hooks, S type				
	Large	25	10	F	—
	Small	50	10	F	—
	Emergency slaughter				
	Block and tackle	1	10	F	—
	Blood bin	1	3	F	—
	Scald tank (1.53 metres × 0.92 metres)	1	10	F	E
	Scraping table	1	10	F	—
	Offal truck	1	10	F	—
	Lights hooks	1	20	F	—
	Knife steriliser/WHB/soap dispenser (stainless steel)	1	10	F	E
	Dressing rail	1.83 metres	30	F	E
	Working table (galvanised)	1	5	F	—
	Accessories to slaughterhalls				
	Whetstone	1	10	F	—
	Oilstones	3	2	F	—
	Nailbrushes, towels etc	—	1	F/L	—
	Clock	2	20	F	E
D	**Hanging room**				
	Railage included in C above				
	Cold stores:				
	Room 1: 140 sq metres/ 329 cu metres 69, 938 BTU's/hour		30	F	E
	Room 2: 105 sq metres/ 234 cu metres 40, 436 BTU's/hour		30	F	E
	Room 3: 88 sq metres/204 cu metres 54, 536 BTU's/hour		30	F	E
E	**Offal room**				
	Pluck sprinklers	2	5	F	—
	Preparation tables (stainless steel)	2	10	F	—
	S hooks	1000	10	F	—
	WHB	1	10	F	E

	Item	No	Life (years)	Foreign (F) or Local (L)	Erection cost (E)
E	**Offal room**—*contd*				
	Tripe tables (stainless steel)	7	15	F	–
	Tripe washers	3	10	F	E
	Manure trucks	5	10	F	–
	Tripe containers	7	10	F	–
	Intestine puller	1	10	F	E
	Intestine cleaners/strippers	3	10	F	E
	Grading table	1	20	F	–
	Salting table (plastic or stainless steel)	1	10	F	–
	Curing barrels (plastic or wooden casks)	14	10	F	–
	Waste bins (galvanised)	3	3	F	–
	Salt bin (stainless steel)	1	10	F	–
	WHB	1	10	F	E
	Head washer	1	10	F	E
	Hide frames	825	5	L	E
	Pallets	20	2	L	–
	Weigh scales	1	20	F	–
F	**By-products**				
	Pressure melter (2 tons)	1	20	F	E
	Electric centrifuge plus basket	1	20	F	E
	Fat tank, percolating	1	20	F	E
	Fat tank, settling	2	20	F	E
	Fat pump	1	10	F	E
	Containers	1	10	F	E
	Milling/bagging machine	1	20	F	E
	Scales	1	20	F	–
	Hoist	1	5	F	E
	Hoof scald tank (500 litres)	1	10	F	E
	Hoof scraping table	1	20	F	–
G	**Condemnation**				
	Incinerator	1	10	F	E
	Hoist (block and tackle)	1	10	F	–
	Ash box	1	10	F	–
	Meat cradle	1	20	F	–
H	**Water and sewage**				
	Water				
	Water storage tank (205, 000 litres)	1	20	F	E
	Electric pump (340 litres/hour)	1	10	F	E
	Chlorination plant	1	10	F	E
	Steam generator (plus piping, insulation, spares, accessories, 16 steam hose points)	1	10	F	E
	Effluent				
	Effluent, solid screens	4	10	F	E
	Grease traps	2	10	L	E
	Aerobic treatment plant	1	30	F/L	E

Model 4—contd

	Item	No	Life (years)	Foreign (F) or Local (L)	Erection cost (E)
I	**Personnel**				
	Showers	6	10	F	E
	Toilet/urinals	3+8	10	F	E
	WHB (stainless steel)	4	10	F	E
	Lockers	8	20	L	—
	Stores (clothes)	1	20	L	—
	Knives	60	2	F	—
	Scabbards	30	5	F	—
	Hats	100	2	F	—
	Overalls	100	2	F	—
	Boots (pair)	30	3	F	—
	Aprons	60	2	F	—
	Benches	4	10	L	—
J	**Hygiene**				
	Scrapers, brooms etc.	6	2	F/L	—
K	**Laundry**				
	Sinks (stainless steel)	2	10	F	E
	Boiler (clothes)	1	10	F	E
L	**Offices**				
	2 offices plus 2 lairage office areas plus gatehouse				
	Desks	4	20	L	—
	Chairs	6	10	L	—
	Safe	1	20	F	E
	Equipment (various £1,500)	—	20	F	—
M	**Mess room**				
	Tables	6	20	L	—
	Benches	12	10	L	—
	Hotplate	4	10	F	—
	Sinks (stainless steel)	2	15	F	E
	Urn	1	10	F	—
	Store cupboard	1	20	L	—
N	**General**				
	Insectocutors	12	10	F	E
	Fans	8	10	F	E
	Standby electricity generator	1	30	F	E
	Fencing	320 metres	10	F/L	E
	Tractor (mini)	1	10	F	—
O	**First aid room**				
	Couch	1	20	L	—
	Blanket	2	10	F/L	—
	Chair	1	10	L	—
	Pillow	1	10	F/L	—
	First aid cabinet	1	10	F/L	—
	Sink (stainless steel)	1	20	F	E
	Refrigerator	1	20	F	—

Appendix IV

Some UK manufacturers and suppliers of abattoir equipment and services[1]

Detailed lists of equipment and services may be obtained by contacting the individual suppliers listed below. This list includes companies who are both known to TPI and have expressed willingness to be included in this publication. We apologise to companies whom TPI failed to contact.

SUPPLIERS AND MANUFACTURERS OF SLAUGHTER AND ANCILLIARY EQUIPMENT

Bristol Abattoir Equipment Co.
Russel Town Avenue
Lawrence Hill
Bristol BS5 9JQ
England Telegrams 'Meat Plant Bristol'

Brook and Crowther Limited
Albion Works
Leeds Road
Huddersfield
Yorkshire HD2 1XW
England Telegrams 'Onward, Huddersfield'

J S Engineering Norfolk) Limited
Round Well Works
Dereham Road
Costessay
Norwich NR5 OSB
England Telex 975074

Simon Johnson Limited – part of the Simon Food Engineering Group
Hempstead Lane·
Gloucester 9L2 6HW
England Telex 43137

Simon-Iwel Limited
64 Essex Road
London N1 8LR
England Telegrams 'Turbinism', London N1

DESIGN, MANUFACTURE AND INSTALLATION OF BY-PRODUCT PLANT

Alfa-Laval Company Limited
Great West Road
Brentford
Middlesex TW8 9BT
England Telegrams 'Alfa-Laval London' Telex 935435

Lensfield Products Limited
Maulden Road
Fitwick
Bedford MK45 5BS
England

(1) We would point out that mention of a company and/or product, and its use in the cost models, does not imply a recommendation of the company (or product) to the exclusion of others which may also be available.

DESIGN, MANUFACTURE AND INSTALLATION OF BY-PRODUCT PLANT—*contd*

Simon-Iwel Limited
64 Essex Road
London N1 8LR
England Telegrams 'Turbinism London N1'
Telex 21402

Douglas-Rownson — part of the Simon Food Engineering Group
Hempstead Lane
Gloucester 9L2 6HW
England Telex 43137

Pennwalt Limited
Doman Road
Camberley
Surrey GU15 3DN
England Telex 858283

DESIGN, MANUFACTURE AND INSTALLATION OF LIVESTOCK PENNING

Gush and Dent
Berkelay Avenue
Reading RG1 6JW
England Telex 847531

WEIGHING EQUIPMENT AND SYSTEMS

W and T Avery Limited
Smethwick
Warley
West Midlands B66 2LP
England Telegrams 'Avery Warley'
Telex 339558

Marsden Weighing Machine Group Limited
388 Harrow Road
City of Westminster
London W9 2HU
England

COMPRESSORS, LUBRICATORS AND HIGH PRESSURE WASHERS

C P Equipment Limited
Mill Green Road
Mitcham
Surrey CR4 4XH
England Telegrams 'Seepyko Mitcham'

Flexian Hydraulics Limited
Mitchell Road
Churchfields
Salisbury
Wiltshire SP2 7PZ
England Telegrams 'Flexport, Salisbury UK'
Telex 477019 ASR

W Bateman and Company
Sellarc
Garstang Road
Barton
Near Preston
Lancashire PR3 5AA
England

ELECTRIC FLY KILLERS

Lamb Ranken Limited
19 Church Lane
Wallington
Surrey SM6 7NQ
England

GSPK (Electronics) Limited
Hookstone Park
Harrogate HG2 7BW
Yorkshire
England Telex 57962

HUMANE SLAUGHTERING EQUIPMENT

Accles and Shelvoke Limited
Talford Street Works
Aston
Birmingham 6
England Telegrams Acvoke, Birmingham 6
(Manufacturers and Patentees of the
Supercash Captive Bolt Pistol)

DESIGN, MANUFACTURE AND INSTALLATION OF REFRIGERATION PLANT

Star Refrigeration Limited
Thornliebank Industrial Estate
Glasgow G46 8JW
Scotland Telex 779133

Ernest West and Beynon Limited
242 High Street
Bromley
Kent BR1 1PQ
England Telegrams 'Verikold, Bromley'

Hall-Thermotank International Limited
Home Gardens
Dartford
Kent DA1 1EP
England Telegram Halltherm Drtfd
Telex 896573

Foster Refrigerator (UK) Ltd
(Export Division)
Rollesby Road
King's Lynn
Norfolk PE30 4JU
England Telex 817550

Appendix V

Examples of discounting tables

Discount factor	Present worth of an annuity factor	Capital revovery factor	Rate 10% Year
0.909 091	0.909 091	1.100 000	1
0.826 446	1.735 537	0.576 190	2
0.751 315	2.486 852	0.402 115	3
0.683 013	3.169 865	0.315 471	4
0.620 921	3.790 787	0.263 797	5
0.564 474	4.355 261	0.229 607	6
0.513 158	4.868 419	0.205 405	7
0.466 507	5.334 926	0.187 444	8
0.424 098	5.759 024	0.173 641	9
0.385 543	6.144 567	0.162 745	10
0.350 494	6.495 061	0.153 963	11
0.318 631	6.813 692	0.146 763	12
0.289 664	7.103 356	0.140 779	13
0.263 331	7.366 687	0.135 746	14
0.239 392	7.606 080	0.131 474	15
0.217 629	7.823 709	0.127 817	16
0.197 845	8.021 553	0.124 664	17
0.179 859	8.201 412	0.121 930	18
0.163 508	8.364 920	0.119 547	19
0.148 644	8.513 564	0.117 460	20
0.135 131	8.648 694	0.115 624	21
0.122 846	8.771 540	0.114 005	22
0.111 678	8.883 218	0.112 572	23
0.101 526	8.984 744	0.111 300	24
0.092 296	9.077 040	0.110 168	25
0.083 905	9.160 945	0.109 159	26
0.076 278	9.237 223	0.108 258	27
0.069 343	9.306 567	0.107 451	28
0.063 039	9.369 606	0.106 728	29
0.057 309	9.426 914	0.106 079	30
0.052 099	9.479 013	0.105 496	31
0.047 362	9.526 376	0.104 972	32
0.043 057	9.569 432	0.104 499	33
0.039 143	9.608 575	0.104 074	34
0.035 584	9.644 159	0.103 690	35

Rate 10%

Discount factor	Present worth of an annuity factor	Capital recovery factor	Year
0.032 349	9.676 508	0.103 343	36
0.029 408	9.705 917	0.103 030	37
0.026 735	9.732 651	0.102 747	38
0.024 304	9.756 956	0.102 491	39
0.022 095	9.779 051	0.102 259	40
0.020 086	9.799 137	0.102 050	41
0.018 260	9.817 397	0.101 860	42
0.016 600	9.833 998	0.101 688	43
0.015 091	9.849 089	0.101 532	44
0.013 719	9.862 808	0.101 391	45
0.012 472	9.875 280	0.101 263	46
0.011 338	9.886 618	0.101 147	47
0.010 307	9.896 926	0.101 041	48
0.009 370	9.906 296	0.100 946	49
0.008 519	9.914 814	0.100 859	50

Rate 8%

Discount factor	Present worth of an annuity factor	Capital recovery factor	Year
0.925 926	0.925 926	1.080 000	1
0.857 339	1.783 265	0.560 769	2
0.793 832	2.577 097	0.388 034	3
0.735 030	3.312 127	0.301 921	4
0.680 583	3.992 710	0.250 456	5
0.630 170	4.622 880	0.216 315	6
0.583 490	5.206 370	0.192 072	7
0.540 269	5.746 639	0.174 015	8
0.500 249	6.246 888	0.160 080	9
0.463 193	6.710 081	0.149 029	10
0.428 883	7.138 964	0.140 076	11
0.397 114	7.536 078	0.132 695	12
0.367 698	7.903 776	0.126 522	13
0.340 461	8.244 237	0.121 297	14
0.315 242	8.559 479	0.116 830	15
0.291 890	8.851 369	0.112 977	16
0.270 269	9.121 638	0.109 629	17
0.250 249	9.371 887	0.106 702	18
0.231 712	9.603 599	0.104 128	19
0.214 548	9.818 147	0.101 852	20
0.198 656	10.016 803	0.099 832	21
0.183 941	10.200 744	0.098 032	22
0.170 315	10.371 059	0.096 422	23
0.157 699	10.528 758	0.094 978	24
0.146 018	10.674 776	0.093 679	25

Rate 8%

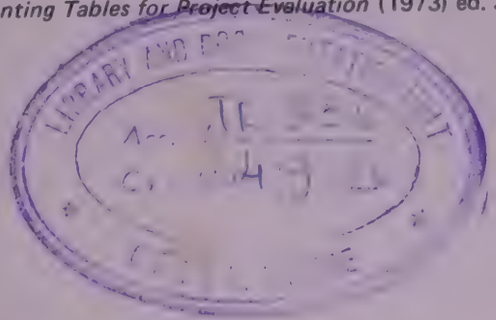
Discount factor	Present worth of an annuity factor	Capital recovery factor	Year
0.135 202	10.809 978	0.092 507	26
0.125 187	10.935 165	0.091 448	27
0.115 914	11.051 078	0.090 489	28
0.107 328	11.158 406	0.089 619	29
0.099 377	11.257 783	0.088 827	30
0.092 016	11.349 799	0.088 107	31
0.085 200	11.434 999	0.087 451	32
0.078 889	11.513 888	0.086 852	33
0.073 045	11.586 934	0.086 304	34
0.067 635	11.654 568	0.085 803	35
0.062 625	11.717 193	0.085 345	36
0.057 986	11.775 179	0.084 924	37
0.053 690	11.828 869	0.084 539	38
0.049 713	11.878 582	0.084 185	39
0.046 031	11.924 613	0.083 860	40
0.042 621	11.967 235	0.083 561	41
0.039 464	12.006 699	0.083 287	42
0.036 541	12.043 240	0.083 034	43
0.033 834	12.077 074	0.082 802	44
0.031 328	12.108 402	0.082 587	45
0.029 007	12.137 409	0.082 390	46
0.026 859	12.164 267	0.082 208	47
0.024 869	12.189 136	0.082 040	48
0.023 027	12.212 163	0.081 886	49
0.021 321	12 233 485	0.081 743	50

Rate 15%

Discount factor	Present worth of an annuity factor	Capital recovery factor	Year
0.869 565	0.869 565	1.150 000	1
0.756 144	1.625 709	0.615 116	2
0.657 516	2.283 225	0.437 977	3
0.571 753	2.854 978	0.350 265	4
0.497 177	3.352 155	0.298 316	5
0.432 328	3.784 483	0.264 237	6
0.375 937	4.160 420	0.240 360	7
0.326 902	4.487 322	0.222 850	8
0.284 262	4.771 584	0.209 574	9
0.247 185	5.018 769	0.199 252	10
0.214 943	5.233 712	0.191 069	11
0.186 907	5.420 619	0.184 481	12
0.162 528	5.583 147	0.179 110	13
0.141 329	5.724 476	0.174 688	14
0.122 894	5.847 370	0.171 017	15

Discount factor	Present worth of an annuity factor	Capital recovery factor	Rate 15% Year
0.106 865	5.954 235	0.167 948	16
0.092 926	6.047 161	0.165 367	17
0.080 805	6.127 966	0.163 186	18
0.070 265	6.198 231	0.161 336	19
0.061 100	6.259 331	0.159 761	20
0.053 131	6.312 462	0.158 417	21
0.046 201	6.358 663	0.157 266	22
0.040 174	6.398 837	0.156 278	23
0.034 934	6.433 771	0.155 430	24
0.030 378	6.464 149	0.154 699	25
0.026 415	6.490 564	0.154 070	26
0.022 970	6.513 534	0.153 526	27
0.019 974	6.533 508	0.153 057	28
0.017 369	6.550 877	0.152 651	29
0.015 103	6.565 980	0.152 300	30
0.013 133	6.579 113	0.151 996	31
0.011 420	6.590 533	0.151 733	32
0.009 931	6.600 463	0.151 505	33
0.008 635	6.609 099	0.151 307	34
0.007 509	6.616 607	0.151 135	35
0.006 529	6.623 137	0.150 986	36
0.005 678	6.628 815	0.150 857	37
0.004 937	6.633 752	0.150 744	38
0.004 293	6.638 045	0.150 647	39
0.003 733	6.641 778	0.150 562	40
0.003 246	6.645 025	0.150 489	41
0.002 823	6.647 848	0.150 425	42
0.002 455	6.650 302	0.150 369	43
0.002 134	6.652 437	0.150 321	44
0.001 856	6.654 293	0.150 279	45
0.001 614	6.655 907	0.150 242	46
0.001 403	6.657 310	0.150 211	47
0.001 220	6.658 531	0.150 183	48
0.001 061	6.659 592	0.150 159	49
0.000 923	6.660 515	0.150 139	50

Source: *Compounding and Discounting Tables for Project Evaluation* (1973) ed. J. Price Gittinger. IBRD.



Printed in England for Her Majestys Stationery Office by Hobbs the Printers of Southampton
(4) Dd0574721 3,500 4/79 G3313